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HICKORY SHAD EGGS AND LARVAE REARED SUCCESSFULLY IN LAB.

Hickory Shad Long Believed by Experts to Spawn at Sea After Fresh Water Sojourn

One of the classic mysteries of fishery science in North America has been where and when the anadromous hickory shad, **Pomolobus mediocris,** spawn along the Atlantic Coast. This species is an important game fish in Bay tributaries of Maryland during spring months. No one has successfully hatched and reared the eggs and larvae so that they might be distinguished from the early developmental stages of the Atlantic shad and two species of branch herrings. The confused state of knowledge about this phase of the hickory shad's life history was stated in S. F. Hildebrand's and W. C. Schroeder's classic **Fishes of Chesapeake Bay** published in 1928 when they said in summary: "The information gathered during the investigation leads to the belief that the hickory shad leaves Chesapeake Bay to spawn." An equally authoritative compendium, **Fishes of the Gulf of Maine,** by H. B. Bigelow

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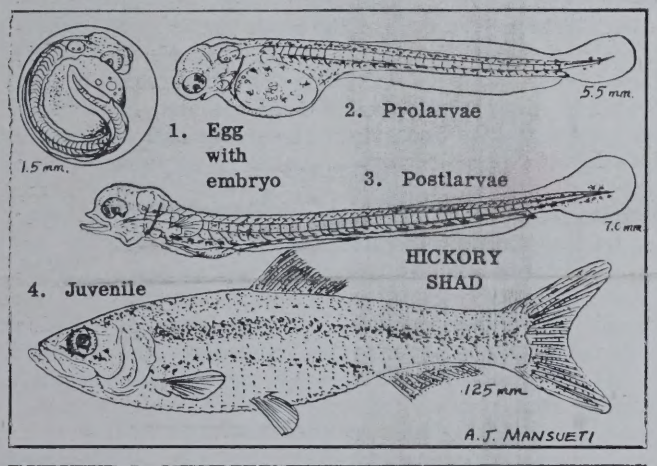

FEW TAMARACK AND YEW TREES STILL FOUND IN UNIQUE GARRETT COUNTY SWAMP

Boreal Plants are Restricted to the Cranesville Swamp

Ecologists have long pointed out that Maryland is unique for having a wide diversity of fauna and flora all out of proportion to its size. Also, the State is well known to be the meeting place of northern and southern animal and plant species. An example of plants from the far north are the tamarack, or Ameri-

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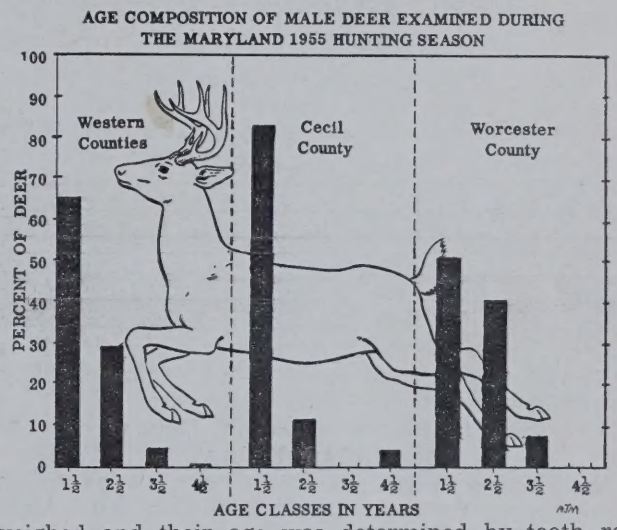
DEER AGE AND WEIGHT STUDY DURING 1955 SEASON COMPLETED

Cecil County Deer Average Heaviest Weight

During the 1955 season, biologists with the cooperation of the Game and Inland Fish Commission were present at six checking stations located in Garrett, Allegany, Washington, Cecil, and Worcester counties. As the deer were brought in they were



weighed and their age was determined by tooth replacement and wear based on methods developed in 1949 by Dr. Severinghaus, a well known deer biologist in New York State. A total of 2,269 deer were registered during this season of which 473 were weighed and their ages determined. The age and weight together with the date and county were recorded for each deer and later compiled. The data accumulated from deer examined during the 1955 hunting season has been partially analyzed with interesting results. Cecil County deer are the heaviest of the three regions studied while those of Worcester County are the lowest in weight (see table below). Cecil County also has the greatest proportion of young deer in the herd indicating a higher production of young deer than in Worcester County which has the lowest production of young deer (see the accompanying figure).

Average Weight of Male Deer Examined in Maryland During the 1955 Hunting Season

	Age Class		
Region	**16-17 Months**	**19 Months**	**30 Months**
Western Maryland	104 lbs.	111 lbs.	122 lbs.
Cecil County	116 lbs.	129 lbs.	140 lbs.
Worcester County	99 lbs.	100 lbs.	126 lbs.

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ALEWIFE HERRING EGGS AND LARVAE REARED SUCCESSFULLY IN LAB.

Life History of this Prolific Species is Little Known

The alewife herring, **Pomolobus pseudoharengus**, locally known as "herrin'," "branch herring," "bigeye herring," and various other names, is one of the most prolific, and yet little-known migratory fishes of Chesapeake Bay and tributaries. It is a marine species most of its life, entering the Bay estuary from the ocean as an adult during spring months and migrating upstream to tidal and lowland fresh waters to spawn. During the last 10 years it has led all Maryland fin-fisheries in commercial production, averaging about 4,000,000 pounds annually. It is caught in prodigious numbers throughout its range from Nova Scotia to the Carolinas, but facts about its life history are meagre. The incomplete state of knowledge is exemplified by Bigelow and Schroeder's classic **Fishes of the Gulf of Maine,** revised in 1953, in which they repeated the statement of John A. Ryder and E. E. Prince, biologists who studied the early developmental stages 50 to 75 years ago, that the eggs " . . . stick to brush, stones, or anything else they may settle upon." Actually, studies at the Chesapeake Biological Laboratory show that the eggs taken from fish in Maryland waters are adhesive immediately after being extruded, but a short time later they become free and can be moved about individually by water currents. Accurate information about such aspects in the life history of our commercial and sport fishes is needed so that work can be carried out efficiently when the location and range of spawning areas is to be ascertained. It is necessary to distinguish the eggs and larvae of this from other species that spawn in the same area. The alewife is only one of the many species that is incompletely known in the early developmental stages.

Females Spawn in Shallow Areas of Tidal Fresh Waters

Alewives spawn in fresh water, sometimes ascending far upstream into small trickles in shallow water. Two types of habitat in which they have been observed spawning this spring, for example, include the broad Susquehanna River flats and tributaries, where roe females were observed swimming close to shore followed by an entourage of males, and in the narrow river valley of the Patuxent River between Hills and Priests Bridge, where spawning fish carry out such vigorous activities that their tails slap the surface and occasionally they are momentarily seen half out of water. The eggs are apparently broadcast at random during the mating movements, for they do not build nests or lay their eggs in special niches. Eggs have been collected with plankton nets in these habitats and they compare exactly with those eggs studied in the lab. Hugh M. Smith, a famed U. S. Bureau of Fisheries biologist, estimated in 1907 that the average number of eggs produced from over 600 females taken in the Potomac River was a little over 100,000 eggs per female, but additional study of this phase, as well as many others, is needed for this important species of fish.

Tiny Eggs Develop Rapidly, Begin Hatching in Two Days at 60° F.

Adult fish in spawning condition were taken during mid-March and early April, 1955, and late March to April, 1956, at a temperature beginning at 50° F., in the catches of commercial haul seiners in the Northeast and Patuxent Rivers. The eggs and milt were stripped from live fish, the former having an apple sauce-like consistency when exuded. Heavier than water, the clumps of eggs were slightly adhesive, but when milt from male fish was added to the spawning bowls and after the eggs were stirred gently with the fish's tail, the eggs individually became separated. The outer membrane of the egg expanded to almost exactly one millimeter (1/25 inch) in diameter after "water hardening." The alewife's egg is much smaller than that of the American shad, its close relative. There is not much of a breathing space between the outer shell and the inner yolk and cellular area which becomes the embryo, as in the shad and striped bass egg. The development within the yolk is rapid, for the animal pole divides in such a manner that the 32 and 64 cell stages can be observed three or four hours after fertilization at an average of about 60° F. Embryos with pulsating hearts that twitched vigorously within the egg when disturbed were well-developed 30 or 35 hours after fertilization, at 60° F. Almost two days after procuring the eggs, the larvae began to hatch and all had hatched in the following three days.

Alewife Larvae Are Tiny, Transparent, and With Few Pigment Cells

Larval alewives are tiny, transparent and elongate creatures with large eyes and an enlarged yolk sac. They are about 4 mm. in total length (1/6 inch) after hatching and in a week and a half they are about 6 mm. in total length (¼ inch). The only markings on the otherwise colorless body are some melanophores, or black pigment cells, behind the eyes, along the ventral portion of the body to the vent, and on the ventral part of the tail. Such markings are useful in distinguishing this species from other herring-like larvae. Within 4 or 5 days the yolk sac is almost completely absorbed, but prior to this period, the larvae swim about actively wriggling like miscroscopic eels. Detailed observations were made on the reaction of larvae when introduced to various potential foods such as live cultures of **Spirostomum** protozoans, green **Pleodorina** colonial flagellates, **Artemia** brine shrimp nauplii, green Euglenoid flagellates, a sample of river water containing a mixture of many microscopic organisms consisting of protozoans, one-cell plants, immature stages of various invertebrates, and in control tanks of water containing no food. None of the fish were observed to have any of these organisms in their intestinal tract through a 6-day test period, although feeding movements were observed. Larvae, however,

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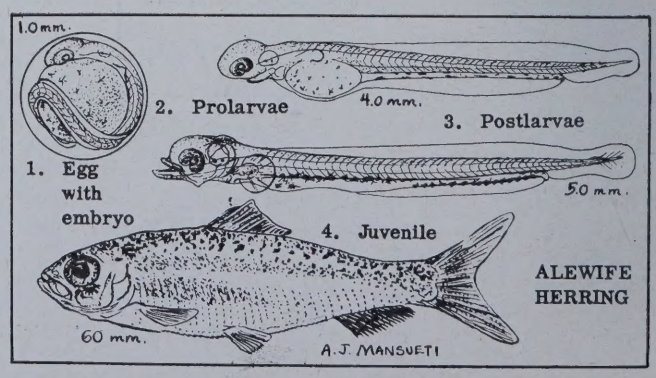

ALEWIFE HERRING EGGS AND LARVAE REARED SUCCESSFULLY IN LAB.

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were maintained alive for over two weeks, but shortly afterwards every specimen died, probably because they were unable to bridge the crucial nutritional gap. Just before dying many of the larvae had formed numerous rays on the pectoral fins and the tail and in the fin region where the dorsal and anal fins would be located. In addition the vertebrae were plainly visible and indications of transformation from a larvae to a juvenile were evident.

Rearing Larval Fish to Juvenile Stage is a Major Problem

There are many problems associated with rearing larval fish under laboratory conditions. The most important is to rear larvae through transformation to the juvenile stage, for such information is valuable in ecological and racial studies. In addition to solving problems of development and transformation for each species of fish, the biologist must learn what factors control the survival and growth of larval fish under laboratory conditions so that he can see the effect of various temperatures, for example, on the number of fin-rays in a certain sample of fish. Once controlling factors are understood and can be manipulated under artificial conditions, then it might be possible to rear many species of fish that have heretofore been given up or neglected because of the death of larvae after the absorption of the yolk sac. Many facts have been gathered at the Chesapeake Biological Laboratory on this facet of basic research, and work will continue in this direction for other species. Technical reports will be published as each species is studied and progress reports will be made in future issues of the **Maryland Tidewater News.**—R. J. MANSUETI.

HICKORY SHAD EGGS AND LARVAE REARED SUCCESSFULLY IN LAB.

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and W. C. Schroeder, published in 1953, cited Hildebrand and Schroeder's findings, further remarking, "This opens the interesting possibility that the 'green" fish (roe hickory shad not ripe enough to spawn) found in Chesapeake Bay, leave the Bay, perhaps to spawn in salt water." Two schools of thought on this question exist: (a) those who believe the hickory shad to ascend rivers from the ocean during spring for a short sojourn and then return to sea to reproduce (includes such authorities as D. S. Jordan and B. W. Evermann, H. W. Fowler, and Hildebrand and Schroeder); and (b) those who believe that this species, with the Atlantic shad, alewife herring and glut herring, ascend estuaries to fresh water to spawn (includes among others, H. M. Smith, M. McDonald and E. C. Raney).

Relatively Large Transparent Eggs Hatch in About Two Days at 64° F.

All of the large tributaries of Chesapeake Bay have sizable runs of hickory shad during the spring months. For the past two years, over 500 freshly caught roe and buck hickory shad were examined in the creels of anglers and in the commercial catches of fishermen on what was believed to be the spawning grounds in the Patuxent River, Choptank River and Northeast River. During the period "green" roes and "spent" (spawned-out) females were found, but no "running-ripe" individuals (i.e., eggs ripe enough to be exuded freely) were found until May 10, 1956, when a female hickory shad was found to be reproductively ripe for stripping at Queen Anne's Bridge on the upper Patuxent River. The eggs were spawned out in large finger bowls, and a running-ripe male ("bucks" were found to be in ripe condition throughout their fresh water sojourn) was used to fertilize the eggs. Only about 5 percent of the eggs seemed to be fertile and in good condition. The eggs, about 1½ mm. (1/16 in.) in diameter, were perfectly transparent with a large yolk mass. Three hours after fertilization at 64° F., 4 and 8 cell stages were observed, and about 9 hours later, cell divisions were no longer visible, indicating an advanced state. About 20 hours later, an early-stage embryo was evident, and about 35 hours after fertilization, it was well-formed and transparent with large eyes, long tail, pulsating heart, and no pigment. The larvae began hatching when they were about 50 hours old, some breaking out tail first and others head first.

Colorless Larvae Swim About Rapidly in an Eel-Like Fashion

Larval hickory shad, about 6 mm. (¼ in.) in length at hatching, wriggled eel-like and with great speed. Their yolk sac was greatly enlarged and their general outline seemed very much like larval Atlantic shad and branch herring at hatching. Sketching live hatchlings was difficult because of their incessant activity. They would swim toward the surface, drop to the bottom on their sides, and then swim up or around their receptacle, rarely resting for more than a few seconds. About 10 or 20 hours after hatching the vertebrae were evident, and very fine black pigment cells were observed on the yolk sac or belly, along the margin of the intestine, and on the tail region. Eight days after the eggs were fertilized, the yolk sac was completely absorbed and the fish were elongate and transparent, with the exception of the markings cited above. They had added a little over ½ mm. more to their length. Efforts were made to feed them shortly after hatching with brine shrimp nauplii, which were small enough for them to eat, but none were observed in the stomachs. All fish perished by May 19th.

Unknown Eggs Collected in 1953-1954 in Upper Patuxent Found to be Hickory Shad

As a result of the hatching and rearing studies with the hickory shad, another puzzle has been cleared up. Egg and larval collections made at Queen Anne's Bridge in the spring of 1953 and 1954 contained a number of relatively large clear eggs that did not fit the descriptions of those produced by Atlantic shad and branch herrings. With a knowledge of the size and characteristics of eggs from these herring-like fishes (Atlantic shad—3½ mm., alewife herring—1 mm., and glut herring—1 mm., in diameter), the unknown eggs were compared with the known hickory shad eggs. The former were found to be identical in size and other characteristics to the known eggs. This was further indication that this species normally spawns in fresh water. Why the eggs have never been taken by hatchery workers and reared is not clear. A clue to the answer probably lies with the time and peak of spawning. Spawning probably occurs only at night or early morning during a short period in late spring, as suggested by field observations. The challenging problem of rearing the larvae through the juvenile stage confronts the investigator during the coming seasons.—R. MANSUETI.

TAGGED STRIPED BASS RECAPTURED AFTER SEVEN YEARS FREEDOM

A tag placed on a nine-inch striped bass on October 3, 1949, at Salem Cove, New Jersey, was found on the fish nearly seven years later on March 21, 1956 at Davis Creek, Kent County, about two miles from Rock Hall, Maryland. The tag was sent to the Chesapeake Biological Laboratory at Solomons by Captain Melvill Sewell of Rock Hall, and forwarded to Dr. Edward C. Raney of Cornell University, coordinator of the current federal-state striped bass research project. The tag resulted from **The Salt Water Sportsman-Schaefer** striped bass tagging program conducted largely by sportsmen along the Atlantic Coast. The size of the recaptured fish, unfortunately, is unknown, but the recovery marks the longest period which has elapsed between tagging and recovery for the plastic disk type tag on striped bass, according to Dr. Raney.—R. MANSUETI.

DEER AGE AND WEIGHT STUDY DURING 1955 SEASON COMPLETED

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Age and Weight Reflect the Relationship of Deer to their Environment

One method of determining how close the deer are to the carrying capacity of their locality is to examine the habitat and the extent of browse. This method requires a great expenditure of time and effort. Without a very careful appraisal the amount of deer browsing is not readily apparent until the danger point has been reached and a browse line appears. A more satisfactory method for estimating the balance between the deer and their environment is to let the deer speak for themselves. The age composition of the herd and the average weights of deer reflect the relationship of the deer to their environment. As the herd begins to become overcrowded the average size of deer of various age groups becomes smaller. The overcrowded herd also has a lower percentage of young deer than does the herd that is not so crowded.

Ideal Management Keeps the Deer Herd at the Point Permitting Maximum Harvest

Since Maryland's first deer season in 1932 when 35 deer were reported shot the legal kill has gradually increased until 2,660 deer were shot in 1955. This increasing yearly kill primarily reflects the growth of the Maryland deer herd. The deer herd cannot keep on growing forever. If the herd increases too much it may consume more than the yearly production of its food plants. As a result of too large a herd the region may end up being able to support a considerably smaller herd than would have been possible if the deer had been prevented from eating themselves out of house and home. The ideal management situation would be to keep the deer herd at the point permitting the maximum harvest. This point is difficult to determine accurately and probably fluctuates to a large extent. It is worthwhile to try to keep the herd at this level because the deer have the greatest recreational value at this point, yet they have ample food and cause less damage to farm crops or forest plantations than occurs when the deer are overcrowded.—V. F. FLYGER.

FEW TAMARACK AND YEW TREES STILL FOUND IN UNIQUE GARRETT COUNTY SWAMP

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can larch, **Larix laricina,** and the yew, or ground hemlock, **Taxus canadensis.** Few people know about the occurrence of these strange trees in Maryland. As far as the State is concerned, these unusual forms have been found growing naturally in Garrett County in peculiar upland swamps, at one time in a 10-acre expanse about 7 miles northeast of Oakland, near Thayersville, and presently at the last stronghold along our political boundary near Cranesville, about 10 miles northwest from the Thayersville location. Dr. F. W. Besley, the well-known Maryland forester, stated that "So far as I know this is the southernmost native stand of tamarack." Biologists have long pointed out the interesting feature of these "islands" on mountain tops, and they refer to such areas as being in the Canadian Biotic Province, a life zone with characteristic boreal animals and plants. Other plant forms found with tamarack and yew include black spruce, which is also becoming scarce, hemlock, rhododendrons, cranberries, and other vegetation peculiar to this type of habitat. The Cranesville Swamp, which straddles the north-south Maryland -West Virginia boundary, is an intensely interesting area. Cuttings in this unusual swamp were noted last summer by the author, thus it may be appropriate at this time to remark on its scientific and aesthetic value.

Unusual Northern Herbaceous Plants Found in Cranesville Swamp

The late Dr. Joseph E. Harned, well-known Garrett County botanist and author of **Wild Flowers of the Alleghanies,** published in Oakland, Maryland, in writing about the Cranesville Pine Swamp in 1936 stated that this area represented the last vestige of a gigantic pine forest. He declared that some " . . . very interesting, almost extinct species of truly mountain swamp plants, some of which have heretofore escaped notice . . . " are to be found there. Dr. Forrest Shreve and Dr. H. M. Curran, in the classic **Plantlife of Maryland** and the Maryland Geological Survey volume on Garrett County, respectively, have described the nature of the mountain swamps. Shreve stated that "A large number of boreal species of herbaceous plants which find their southern limit in Maryland or Virginia occur in or about the Swamps and the Bogs which now occupy some of the cleared swamp areas." A list of the unusual plants found in the Cranesville bog may be found in the references cited above. The swamp forests are distinctly coniferous, and at one time black spruce predominated, and white pine, Canadian hemlock, and tamarack were secondary species. Where streams traverse the swamps or where the stand of trees is more open there are dense thickets of rhododendron. The typical mountain bog is also easily observed at the Cranesville Swamp in which the saturated ground is covered with beds of sphagnum moss. Visitors to the privately owned Cranesville Swamp will find it a difficult place to enter, yet it holds many interesting discoveries. West Virginia botanists and ecologists have been especially active in making studies and trips to the area. Investigators from the Maryland Department of Research and Education, and other Maryland naturalists, have made short-term biological surveys of the Cranesville Swamp. A summary of these studies will be issued in a report in the near future.—R. MANSUETI.

MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION Chesapeake Biological Laboratory, Solomons, Maryland
L. Eugene Cronin, Director
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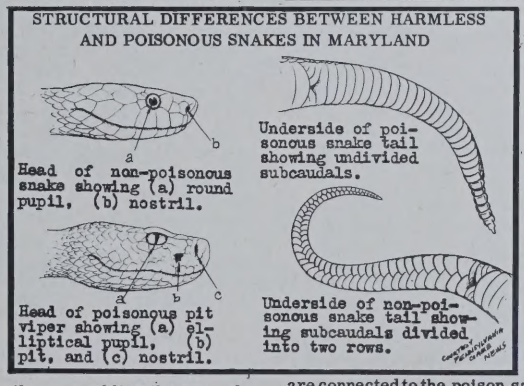
Copperheads and Rattlesnakes, The Only Venomous Reptiles of Maryland

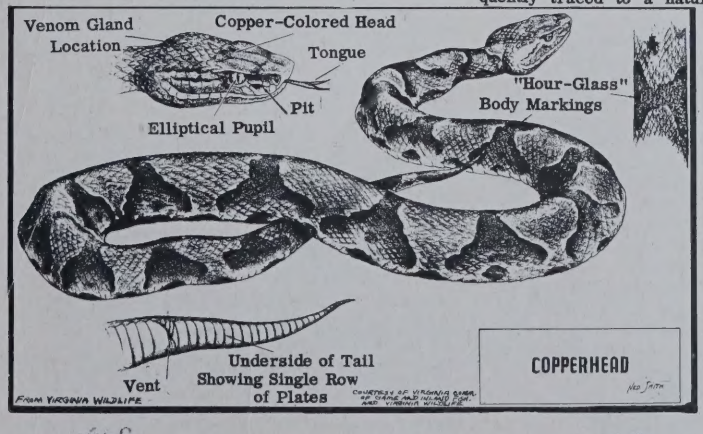
By ROMEO MANSUETI

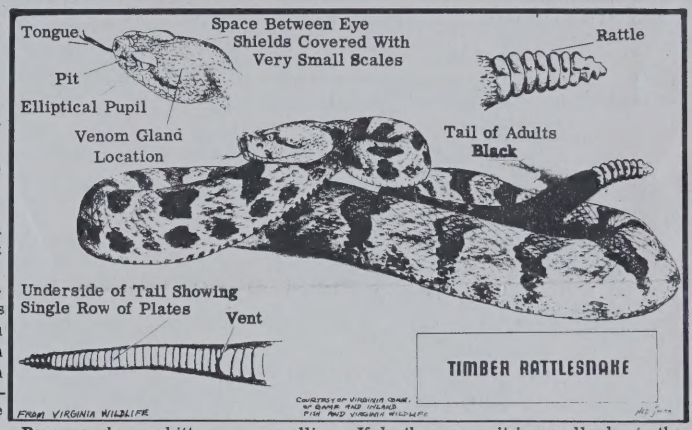
ONLY TWO OUT OF 26 KINDS OF SNAKES ARE DANGEROUS IN MARYLAND. The wide variety of habitats from the Coastal Plain of Southern Maryland and the Eastern Shore to the mountains of the Alleghany Plateau of Western Maryland plays host to 26 different kinds of snakes. Of these, only two species, the copperhead, Ancistrodon contortrix and the timber rattlesnake, Crotalus horridus horridus, are poisonous. There are no poisonous "water moccasins or cottonmouth moccasins" found in or close to Maryland in spite of widespread belief to the contrary. The harmless water snake is the culprit in most of the cases of such reports. The two venomous forms are large and spectacular species, but fortunately they are either too secretive or restricted in their distribution to be of serious concern in the State. Potentially, they pose a real hazard for hikers, mountain climbers, boy scouts, suburbanites, and anyone else who takes to the woods and hillsides in spring and summer months. The accurate recognition of these pit-vipers, and a knowledge of their habitats and distribution may prove useful to Marylanders who encounter snakes in pursuit of their vocation and avocation.

NASAL PITS, ELLIPTICAL PUPILS, AND HOLLOW FANGS SET POISONOUS APART FROM HARMLESS SNAKES. Poisonous snakes are separated from the non-venomous forms by several well-defined characteristics: (1) the presence of a large pit on either side of the head in front of the eye, in addition to the pair of small nostrils near the tip of the snout - harmless snakes do not have these pits; (2) the presence of "slits" or elliptical pupils, resembling the eyes of cats, during daylight; - harmless snakes in Maryland have round pupils at all times; (3) the presence of a pair of large, movable fangs at the front of the upper jaw of the mouth - harmless snakes do not possess such large teeth; (4) the underside of the tail of poisonous snakes shows undivided plates - harmless snakes have two rows; and (5) the less-reliable triangular shape of the head in pit vipers due to the enlargement of the poison glands - harmless snakes usually do not have such flat lance-shaped heads, but certain species, especially water snakes, will spread their head into a well-defined triangular shape when frightened. Unfortunately there is no simple rule for separating poisonous from harmless snakes at a glance. The importance of knowing whether a snake is dangerous or not is great whenever there is a remote possibility that venomous snakes occur where you live, work or play. Much undue anxiety and pain could be avoided by definite identification of the kind of snake concerned. Persons who are bitten should make an extra effort to learn whether the snake is deadly or not. Snakes need not be feared if we know them, understand their habits, and follow common safety rules.



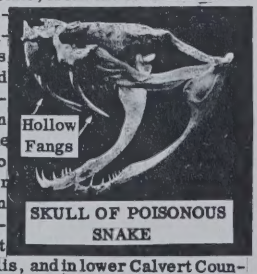
POISON APPARATUS CONSISTS OF HOLLOW FANGS AND LARGE VENOM SAC BEHIND EYES. The venom and the method of injection into its prey or a hapless human's leg or arm are remarkable inventions of nature. The hypodermic-needle-like fangs and the venom gland are primarily designed for the capture of prey, and are used in defense against human intruders only in a secondary manner. The sharp, curved fangs are highly modified hollow teeth that are connected to the poison sac in which the venom is secreted and stored. The flicking forked tongue of harmless and poisonous snakes is a feeler and an aid for picking up odors. It should not be confused with fangs which fold back in the roof of the mouth. When a copperhead or rattlesnake bites, the fangs enter the body of its prey in a spear-like fashion, and at the same time muscles constrict around the glands, forcing venom through the hollow fangs. It is easy to see why the origin of the hypodermic syringe and needle used by a doctor is frequently traced to a natural model in venomous snakes. The venom of poisonous snakes is an amber-colored, almost clear fluid, resembling diluted maple syrup. The poison of copperheads and rattlesnakes affect the blood and any cells with which it comes in contact. Normally it is injected into spaces between the cells, and is slowly carried in the lymphatic system to the heart. The red blood cells are broken down, especially those of vessel walls, forming accumulations of fluid and swelling. If death occurs, it is usually due to the loss of too many red blood cells and asphyxiation through lack of oxygen which the cells normally carry to the body tissues.



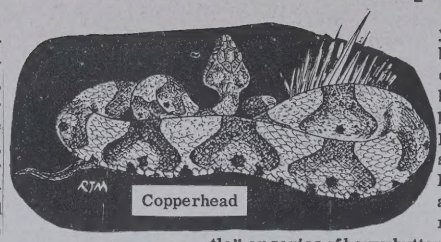


COPPERHEAD IS A STRIKING AND COLORFUL SPECIES. The copperhead is one of the most strikingly patterned and colorful of our native reptiles. Its uniform coppery-red head and body with 15 to 25 dark brown crossbands against a pale salmon ground color serve to identify it. The crossbands are unique because they resemble hourglass markings, i.e., they are wide on the sides of the body and narrow over the backbone. No other snake is marked exactly like it, although many people confuse the red rat snake, milk snake, hognose snake and water snake with it, because of the presence of red or brown markings on these non-poisonous snakes. The belly is whitish with dark brown mottlings. A narrow black line from the angle of the jaws to the eye set off the yellowish lips below. It is a heavy-bodied snake with ridged scales. The maximum recorded size for copperheads is said to be 53 inches; a specimen 45 inches long was taken near Annapolis. Specimens rarely exceed 36 inches in length. Juvenile copperheads when born in autumn are about 8 inches long with a bright yellow tail, an ornamentation absent in the adults.

COPPERHEADS ARE COMMONLY FOUND THROUGHOUT STATE, EVEN NEAR SETTLED AREAS. Although the copperhead is commonly found throughout the State, from the lowlands to the mountains, it is so secretive and rarely encountered that reports of bites are few and deaths are highly infrequent. It has been found abundantly by the author in the Patapsco State Park, Gunpowder Falls area, Catoctin National Park, Cranberry Bog in Garrett County, near Annapolis, and in lower Calvert County. Frequently it is the most common snake taken numerically. Other herpetologists have found it a common species throughout southern Maryland, around the District of Columbia, and central and western Maryland. Its occurrence on the low, flat Eastern Shore is less well-documented, nevertheless records are available for every county. Copperheads have been taken within the city limits of Washington and Baltimore, as well as other well-settled localities. Their favorite habitats are

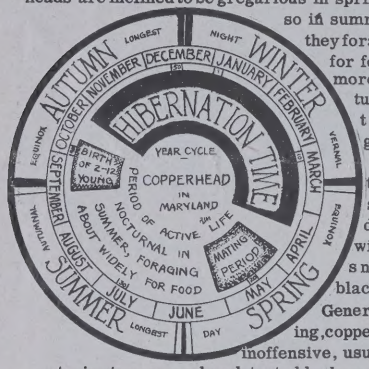


located among rocky outcroppings above the Fall Line, along rugged, forested hillsides, and in mixed deciduous-evergreen forests. They are prone to congregate under debris, boards, building supplies, near barns, any area where conditions are such that mice and shelter are provided. People clearing their land in spring, gathering hay and other crops, and clearing roadsides, encounter them. In short the copperhead appears to be a ubiquitous species that somehow has not caused great excitement because of its retiring habits.

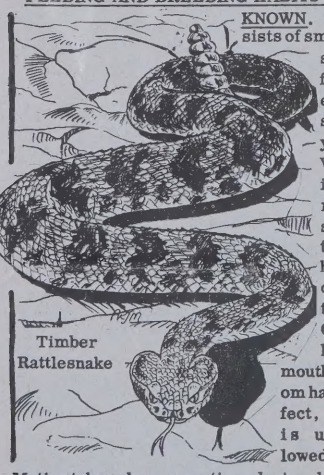


Copperhead

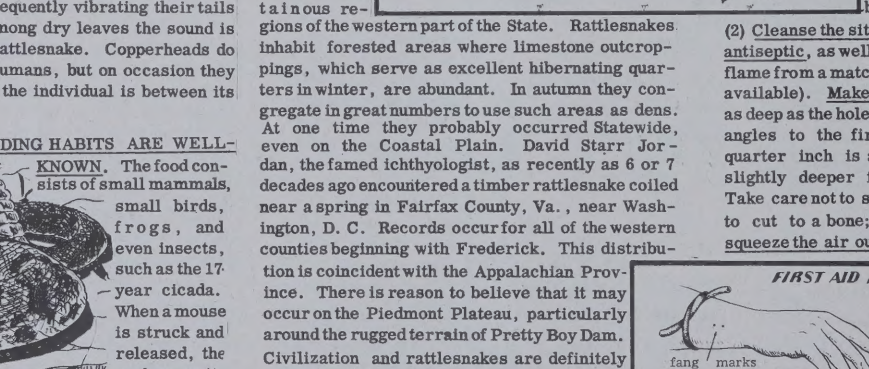
COPPERHEADS ARE SLUGGISH, GREGARIOUS AND NOCTURNAL MOST OF THE TIME. Copperheads are inclined to be gregarious in spring, less so in summer when they forage about for food, and more so in autumn when they congregate for hibernation. They share such den sites with rattlesnakes and blacksnakes. Generally speaking, copperheads are inoffensive, usually hiding or trying to escape when detected by humans. They are active at night and occasionally are killed on country roads where they cross or on which they bask if the asphalt has retained any of the sun's warmth. When cornered or teased they fight and strike out savagely, frequently vibrating their tails so vigorously that among dry leaves the sound is similar to that of the rattlesnake. Copperheads do not purposely attack humans, but on occasion they may seem to do so if the individual is between its hole and the snake.



FEEDING AND BREEDING HABITS ARE WELL-KNOWN. The food consists of small mammals, small birds, frogs, and even insects, such as the 17-year cicada. When a mouse is struck and released, the snake uses its tongue and the heat-detecting organ, the pit, to locate it. Other prey is held within the mouth until the venom has taken its effect, and the prey is usually swallowed head first. Mating takes place sometime during daylight hours in April and May, at which time male copperheads display a very unique combat dance. About 4-6 young per female are born in August and September. Very young copperheads are capable of inflicting a serious wound because they possess the same poisonous apparatus found in adults.


Timber Rattlesnake

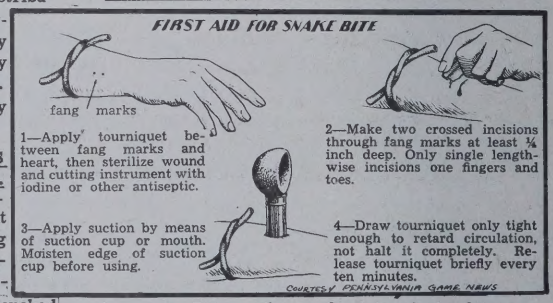
BLACK AND YELLOW COLOR PHASES OCCUR AMONG RATTLESNAKES. The timber rattlesnake is a large and dangerous species. Although its rattle should identify it, occasionally a few or almost all buttons may be missing. There are 2 color phases (not related to sex as often claimed): (1) bright yellow ground color with black or dark brown, chevron-shaped cross-bands; and (2) an almost black phase, in which the light ground color is obscured with dark stippling. The body is moderately heavy, with rough-ridged scales. The "rattle" or series of horny buttons at the end of the tail, is a structure composed of a number of loosely jointed, horny segments. A new-born snake possesses a simple, blunt "pre-button" at the end of the tail, but after the first shedding of the old skin, the rest of the segment of the rattle is formed. Thereafter the snake adds a new segment to the rattle each time it sheds. If it sheds 2 to 4 times a year, that many buttons will be added. A rattlesnake's age can be estimated roughly by dividing the number of segments present by 3, but such an estimate may be quite inaccurate if the terminal rattles have accidentally broken off, as they do frequently in old snakes. The maximum recorded size of the timber rattlesnake is 74 inches, but most specimens are about 36 inches long. Newborn young are about 10 inches long.



RATTLESNAKES ARE RESTRICTED TO MOUNTAINS OF MARYLAND. The timber rattlesnake is highly restricted in its distribution in Maryland, being found and locally abundant in the wild mountainous regions of the western part of the State. Rattlesnakes inhabit forested areas where limestone outcroppings, which serve as excellent hibernating quarters in winter, are abundant. In autumn they congregate in great numbers to use such areas as dens. At one time they probably occurred Statewide, even on the Coastal Plain. David Starr Jordan, the famed ichthyologist, as recently as 6 or 7 decades ago encountered a timber rattlesnake coiled near a spring in Fairfax County, Va., near Washington, D. C. Records occur for all of the western counties beginning with Frederick. This distribution is coincident with the Appalachian Province. There is reason to believe that it may occur on the Piedmont Plateau, particularly around the rugged terrain of Pretty Boy Dam. Civilization and rattlesnakes are definitely not compatible in our State.

LIFE HISTORY OF RATTLESNAKE IS LESS KNOWN THAN THAT OF COPPERHEAD. The timber rattlesnake is a sluggish, non-aggressive species. It is active at night, but during daylight especially in the spring months it is frequently encountered lying motionless and partly in the sunlight. Occasionally, rattlesnakes do not rattle until actually touched, but if aroused and teased they are formidable adversaries. Although rattlesnakes stay near their rocky habitats in spring and fall, in summer they probably wander away from the hills into adjacent open valleys and plains, especially during droughts. Very little information is available on their life history. One authority states that each female produces 7 to 12 young every other year, usually in September. Their food consists of warmblooded prey such as mice, shrews, chipmunks and small birds. Thus they are useful animals insofar as they consume many destructive rodents annually. Some experts believe the damage and fear they and copperheads inflict upon civilization is far outweighed by their economical usefulness.

SNAKE-BITE FIRST AID SHOULD BE MEMORIZED BY ALL. The correct steps in first aid for poisonous snake bite should be memorized by everyone in or near a region where poisonous snakes occur. Proper preventive measures insure against most snake bites. Wear heavy shoes, boots or leggings in poisonous snake country. Stay on roads, paths or trails if possible and always use a flashlight outdoors at night in rural areas. When climbing rocky ledges, look before you grasp. Children should never be allowed to catch or handle poisonous snakes. Bites of non-poisonous snakes often leave a U-shaped pattern of toothmarks. Treat them as simple minor wounds with any good antiseptic. Bites of poisonous snakes, of course, usually show the double puncture of the large fangs. There is much difference of opinion among medical men concerning the best first aid procedure to follow. The steps outlined below, summarized from Roger Conant's excellent Reptiles and Amphibians of the Northeastern States, 1952, 2nd. Ed., (Zool. Soc. of Phila., $1.00), are the simplest ones now generally recommended. If bitten: (1) Apply a tourniquet about 2 inches above the bite. This is to keep the venom localized. Draw it tight enough to impede circulation, but not so much that the blood supply is cut off completely; (2) Cleanse the site of the bite with iodine or other antiseptic, as well as the knife or razor blade (use flame from a match if an antiseptic for knife is not available). Make a cut through the 2 fang punctures as deep as the holes and again through each at right angles to the first cut to promote bleeding; one-quarter inch is adequate for the copperhead, but slightly deeper for a large timber rattlesnake. Take care not to sever a blood vessel or tendon or to cut to a bone; (3) If a suction cup is available, squeeze the air out, moisten the rim, and apply to the wound. Remove the cup about 20 minutes later, drain the contents to the ground, wait one-half hour, and reapply the cup. If no cup is available, sucking may be done by the mouth, provided there are no cuts or sores present. Accidental swallowing of some of the venom will not harm a normal, healthy person; (4) Swelling, discoloration, and intense pain are evident in bites from the poisonous snakes. As swelling advances, it will be necessary to move the tourniquet farther up the bitten limb. Make additional X-shaped cuts and apply the cup to them, one at a time. If necessary, suction may be continued for several hours; (5) A physician should be summoned at once. The patient must remain absolutely quiet and inactive. Exercise speeds up circulation and thus spreads the venom more rapidly through the body. Alcoholic beverages and other stimulants are absolutely forbidden. Antivenin, made from horse serum to neutralize snake poison, is sold with some commercial snake bite kits. It should be used only by doctors, or in extreme cases by informed laymen, specifically on people who are insensitive to foreign serum.



MARYLAND TIDEWATER NEWS

Entered as Second Class Matter at Solomons, Maryland. Office at Chesapeake Biological Laboratory, Solomons, to which all communications should be addressed.

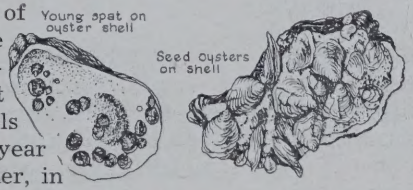
EDITORIAL STAFF: E. T. WALKER, D. G. CARGO, H. J. ELSER, G. F. BEAVEN, & J. R. LONGWELL.

Volume 13 JULY-AUGUST, 1956 No. 2

EARLY SUMMER OYSTER SET GENERALLY LIGHT

Set Recorded by Test Shells

Each season, records of the time and intensity of oyster setting and of the attachment of fouling organisms in certain areas, are obtained by the Laboratory through exposure of test shells. These are clean oyster shells that are put overboard in chicken wire bags for a period of one to two weeks and then replaced by fresh clean shells. By counting under a microscope the number of spat that have attached to the clean inner shell faces during each period, the time and rate of setting during the season can be accurately plotted. At a few stations, shells are exposed the year round in this manner, in order to measure the set of barnacles and other fouling organisms. Experience has shown that hardly ever does the first oyster spat of the season appear before the first of June and none have been recorded later than the month of October. Hence, at most stations where the time and setting rate of spat are measured, shells are exposed only during the above period.



Few Spat This Year Prior to Mid-July

A very few scattered spat attached to shells at most stations during the first part of this summer. Usually a peak of setting occurs in certain areas in late June or July, sometimes followed by one or more later peaks. At some stations, especially in the Solomons area, the light set occurs most often during the fall. St. Marys River, the upper Honga River, both sides of the Bay just above Solomons, and the Patuxent River all had received only a few scattered spat this year from early June to mid-July although the first named areas usually have good accumulations by that time. Scattered data indicate that little set occurred during this same period in Holland Straits and Piney Island Swash. Smith Creek, however, produced a fair set during the week of June 28-July 5 that amounted to about 10 spat shell face. This rate of setting had diminished to very few spat during mid-July.

Success of Set Not Yet Predictable

Even an initial set of ten or more spat per shell face at an age of one week does not insure that many will survive the perils of a microscopic oyster's early life.

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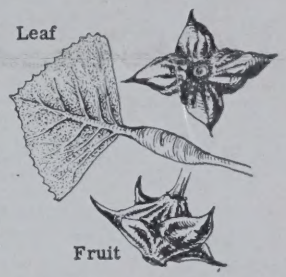
WATER CHESTNUT CONTROL MEASURES CONTINUED BY STATE

Extermination of Plant Sought



The campaign begun last year to eliminate water chestnut, **Trapa natans**, from the waters of Maryland is being continued this summer under the auspices of the Maryland Board of Natural Resources. Survey work, plant identification and designation of control needs are made by the Department of Research and Education. Application of control measures is being done by the Department of Game and Inland Fish with the cooperation of the Department of Tidewater Fisheries and the Department of Forests and Parks. This pernicious water weed prevents navigation in shallow water, crowds out valuable plants, fish, and wildlife, produces spiny seeds that ruin beaches, and provides breeding areas for mosquitos. The seeds produced each summer sink to the bottom and start new crops the following spring after the old parent plants have died out during the winter. Most seeds germinate the first season but some may remain in the bottom for several years and then sprout; thus, all plants that appear in a given area must be destroyed for several successive seasons before they have had a chance to shed their seed. Unless this is

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INITIAL REQUEST FOR SALTONSTALL-KENNEDY FUNDS REJECTED

Funds Asked for Blue Crab Research

Last winter we reported on progress by the Blue Crab Committee of the Atlantic States Marine Fisheries Commission in defining the objectives of a coastwise research program into the cause of drastic fluctuations in the number of crabs available to commercial and sport interests. On March 1st this committee filed a project proposal with the Fish and Wildlife Service for research, under the Saltonstall-Kennedy Act, into the "Factors Affecting Fluctuations in the Abundance of Marketable Blue Crabs." This program sought an allocation of approximately $110,000 annually for five years.

The Committee considered this request a reasonable

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WATER CHESTNUT CONTROL MEASURES CONTINUED BY STATE

(CONTINUED FROM PAGE 1)

done, even one or two plants that are allowed to mature seed can quickly populate an area with new beds.

Pest Reduced From Last Year

A survey of the old beds in the Gunpowder River area made in early June indicated that far fewer plants were present than at the same time last year. However, enough were found on the old beds to build them back quickly if allowed to produce a new seed crop. Last year's control measures demonstrated excellent effectiveness but some old seeds remained and it was not possible to kill every plant before new seeds were formed. Since the time of the early survey more new plants have appeared, as underwater stems branch and late germinating seed come up. Thus far this season, over 70 percent of the area has been treated with 2,4-D spray, using a weed cutter to make paths for the spray boat. Heavy rains, however, have repeatedly washed the spray away before all of the plants had died so that most of the area of the beds is being treated a second time and with a stronger solution.

Interested Citizens Needed to Help Complete the Job

Plants that escaped the first spraying are now developing seed and after these become mature the spraying will be almost useless, for the old plants will die anyway but the seed will remain for next year. Thus, the season for which the spray program is most effective will soon be ended. However, the seed probably will not drop to the bottom before mid August so that if the plants are pulled or cut, and taken ashore with the seeds attached, a future crop can still be prevented. The crews assigned to the spray job should be able to eliminate most of the plants on the existing beds. However, there probably will be scattered or hidden plants that need to be found and pulled before they drop their seeds. Shore owners, including personnel on the Army areas, can help tremendously if they will locate and take ashore any scattered plants they can find before August 15. Even after that date it will be important to find and remove younger plants that have not dropped seed, for seed formation can continue until October. It is hoped that everyone in the area will help do this. If anyone locates large untreated beds that cannot be destroyed by pulling, then one of the local game wardens should be notified so that the spray equipment can be used on them. If this year's campaign is successful, then far fewer plants will appear next season and the ultimate extermination of the pest will be made easier. — G. F. BEAVEN.

CHANGE IN TIDEWATER NEWS EDITORSHIP

Mr. Romeo Mansueti, Editor of the **Maryland Tidewater News** is presently on leave of absence from this post. His duties have temporarily been assumed by a board of editors composed of staff members of the Maryland Department of Research and Education.

It has been planned to continue this publication with the same format and to include articles of the same type as previously found here. However, the paper will, in the future, be issued on a bi-monthly basis rather than on a monthly basis as in the past.

It is anticipated that Mr. Mansueti will resume the editorship next June. — J. R. LONGWELL.

EFFECTS OF FRESHWATER ON ESTUARINE FISHES OF BAY STUDIED

Salinity Poses Many Problems in Movements of of Fishes in Bay Area

Chesapeake Bay is one of the world's finest natural laboratories for studying the distribution and survival of various marine and freshwater animals. This is true because it is an estuary fed by smaller tributary estuaries, where a gradient from fresh to saltwater normally exists. An estuary has its own characteristic inhabitants that have become adapted to wide ranges of salt content in their habitat. Freshwater kills some saltwater fish by saturating their body with water, analogous to drowning. Some freshwater fish, on the other hand, are fatally affected by saltwater which dehydrates or virtually dries them out. Here is how this startling phenomenon occurs.

Osmotic Regulation Necessary in Estuaries

According to one of the basic laws of nature, if we take a membranous bag that will allow the passage of water through its surface but not salt, and pour a 10 per cent salt solution into the membrane, then place it in a tank of pure water, the water will diffuse into the bag until it may actually burst. On the other hand, if we had placed this same bag into a tank containing a twenty per cent salt solution instead of pure water, the water from inside the membrane would pass through it, out into the stronger salt solution, shrinking the bag. In both cases it is the relative concentration of salt which governs the direction of flow of the water. Fish blood contains a concentration of salts higher than freshwater, but more dilute than sea water and the gills of a fish act as such a membrane. Water will diffuse through the gills into any fish living in freshwater, while in the ocean the reverse is true. The problem faced by freshwater fish is to have an excretory system that is capable of eliminating the excess water that diffuses into them. In an environment where the salt concentration is greater, as is the case with fish in the ocean, water will move out of a fish's body and into the surrounding medium. The only way marine fish can replace this water is to swallow large quantities of sea water, so the old saying about "drinking like a fish" is applicable only to saltwater fish.

How Fish Adapt to Salinity Changes Depend on Built-In Mechanisms

Since an excess of salt will also prove fatal, even to marine fishes, they must separate the salt from the sea water, excreting the salt while retaining the water for their bodily functions. Not too much is known about how this is done, but a group of cells found in the gills of some fishes accomplishes this task. A freshwater fish that does not possess this salt-eliminating mechanism will not be able to utilize sea water and, if placed in it, the body fluids diffuse out until it dies. If a marine fish is in freshwater and lacks an excretory system capable of handling water at a rapid rate, it will absorb more than it can excrete until it expires from what resembles drowning.

Fish Distribution is Delimited by Salt Content of Water

Salinity is one of the primary factors governing the

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EARLY SUMMER OYSTER SET GENERALLY LIGHT

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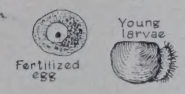

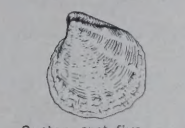

Shells that have been planted for a longer period prior to the set may also be quite foul and so offer little suitable space for spat attachment. Of course, when only a few spat attach initially, the number of surviving set must remain small. Typically, light sets, such as have occurred so far this season, show a much better rate of survival then do more densely crowded sets. It is still too early to predict just how successful this season's oyster set may be, for later peaks of more intensive setting may occur. Only Smith Creek so far has had enough potential spatfall to produce a good crop if commercially planted shells were clean and the rate of survival high.

Knowledge of the Expected Time of Setting Useful

While the amount of spat found on clean test shells exposed each week does not give an accurate picture of the crop to be found on commercially planted shells by late fall, it does offer a means of getting the maximum possible attachment from the set that occurs. Experiments have shown that shells planted just prior to a peak of oyster setting sometimes may obtain two or more times as many spat as shells that have been overboard for several weeks prior to the set. This is due to the shells' cleaner surfaces at the time of spatfall. In some areas a heavy wave of barnacle setting often occurs in late spring or even in early June that can render shells almost useless for spat attachment when the oyster set occurs. A number of years of observation in a given area sometimes may reveal a rather consistant pattern of oyster setting so that a normal date can be picked when shell planting may be done only a short time before the oyster setting peak is most likely to occur. Observations by test shells also may reveal places that seldom obtain significant sets at any season and others that usually produce a high rate of setting. Some use of such observations has been made in shell planting, but in large scale operations, it is not always possible to get all of the shells over at the optimum time even when this is fairly well designated. — G. F. BEAVEN.

SOUTHERN STONE CRAB EGGS HATCHED AT LABORATORY

Stone Crabs Much Larger Than Common Mud Crabs

Egg bearing females of the stone crab a species, much sought after by southern crabbers, have been brought from North Carolina's Bogue Sound to the Solomons laboratory for hatching studies. The stone crabs, **Menippe mercenaria,** are members of the same family of crabs as the mud crabs—commonly found on the oyster bottoms of the Chesapeake Bay. The stone crabs grow much larger, having tremendous claws which may contain several mouthfuls of meat. In some individuals the claws may be as large as those of marketable New England lobsters. The normal range of this species extends from North Carolina to Mexico, although it is possible that stragglers might find their way into the southern part of the Bay.

Hatching Successful After Seven Days in Aquarium

The sponge crabs were collected by Department of Research and Education biologists and rushed to the Solomons laboratory where observations of the hatching eggs were begun. A quantity of water was also brought from the collection site to insure successful hatching of the eggs. Only one crab survived the ordeal of the trip. Her eggs hatched in seven days into a typical crab larval stage known as a zoea which closely resemble those of the blue crab. Most crabs molt through four zoeal stages—each one having a different arrangement of hairs, spines and other parts.

Mature Crabs Live In Burrows

When young, the stone crabs resemble the mud crabs in size, appearance and habits. When they reach a size of five or six inches, they move from the shell bottoms and dig burrows in the shoals, banks and other shallow places. These are usually places with a firm muddy bottom—rarely sand. The openings of the burrows are about six or seven inches in diameter, extending horizontally from one to three feet into the sloping bottom. The less timid crab fishermen catch the crabs with their bare hands. The holes are easily seen in the clear, shallow water at low tide. The waterman reaches into the burrow and quickly pulls out the crab. Care must be taken, lest the larger crabs crush a finger. The more timid fishermen thrust a rod into the burrow which the crabs grab with such a firm hold that they may be pulled out.

Only Claws Used As Food

Normally only the claws of the stone crab are eaten. In North Carolina, the crabs are so well favoured that the supply has dwindled markedly in the past fifty years. In Florida, however, protective measures have been enacted to prevent fishermen from keeping the whole crabs. In this instance, the claws are removed from the crabs which are then released so that a new set of claws may be grown at the next molt. It is possible that similar action in other areas where these animals abound may enable the stone crab to assume an even greater importance as a seafood delicacy. — E. P. RYAN.

STAFF CHANGES AT SOLOMONS

The Department of Research and Education has had several recent changes in personnel. These changes will involve members who are well known to many of the readers of **Maryland Tidewater News** and those leaving will be sorely missed.

Mr. Romeo J. Mansueti has been appointed to the position of Biologist I, in charge of research on salt water fish at the Chesapeake Biological Laboratory. Mr. Mansueti has worked for the laboratory since July, 1950, and has already produced a large number of research papers in many fields of zoology. He has served as editor of the **Maryland Tidewater News** and is at present, conducting important studies in the identification of the egg and larval stages of Maryland fish, the life history of the white perch, and other problems. Among his most important recent papers are "Historical Review of the Shad Fisheries of North America" with Mr. Haven Kolb; "Maryland Natural Resource Bibliography," and his summaries on the life history of the rock or striped bass, the shad, and the sea nettle. Mr. Mansueti replaces Dr. Richard E. Tiller who resigned from the Department in May to accept a position with the Operations Research Office of the Johns Hopkins University.

Mr. Harry A. Hensel, formerly in charge of the fish

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EFFECTS OF FRESHWATER ON ESTUARINE FISHES OF BAY STUDIED

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distribution of fish in the Bay area. Chesapeake Bay has salinities ranging from freshwater to full ocean strength. Off Solomons approximately in the middle of the Bay, the salinity ranges from 10 to 20 parts per thousand. The open sea contains about 35 p.p.t. The Bay, particularly the upper tidal portions of the tributaries, is a transition zone where both fresh and saltwater fish may be found together. As an example, some freshwater species may live quite comfortably in a salinity as high as 10 p.p.t., while some saltwater fishes may find salinities as low as 10 p.p.t. agreeable to them. As we go down the Bay to where the salinity is 15 p.p.t. some of the freshwater fish are absent, and up the Bay in a salinity of 5 p.p.t. some saltwater forms are missing. Seine collections made in such an area often turn up both fresh and saltwater fishes that tolerate such a salinity. Evidently these fish must possess a system that can adapt to this much of a change in salinity from their normal environment.

Freshwater Pond Adjacent to Bay is Study Area

An opportunity to observe estuarine fishes living with freshwater fishes in an area of very low salinity was provided in a habitat near the Chesapeake Biological Laboratory. Located in the Drum Point area is Big Fresh Creek, a 10 acre pond that usually contains freshwater. It is separated from the Bay by a narrow barrier beach. During exceptionally high tides or storms, there is a connection between the Bay and the pond and brackish water flows into the pond. On July 21, the day after a somewhat violent rain storm which probably washed some Bay water into the pond and at the same time presumably diluted the Bay, the salinity of the pond was 2.5 p.p.t. while 50 feet away in the Bay it was 12.6 p.p.t. Oddly enough, some of the Bay fishes not only survive in the pond, but are more numerous than the resident freshwater chain pickerel, largemouth bass and sunfishes. Three species of brackish water topminnows were observed presumably spawning in the pond during June, for some of their young were seined in July. The later seinings produced myriads of silversides, also a Bay fish. Carp, normally freshwater fish, have found their way into the pond via the Bay. White perch, a species usually living in brackish water and only entering freshwater to spawn, have become virtually landlocked in the pond, many of them probably living out their life cycle there. In spring months, they are reported to enter the ponds from the Bay during high tides. They are so abundant that scale samples indicate them to be stunted in their growth. Other organisms such as the blue crab, **Callinectes sapidus,** and various grass shrimps of the genus **Paleomonetes** have crossed the barrier beach and have at least temporarily become adapted to fresher water.

Fresh and Estuarine Species Occur Together in Pond

The following mixture of fresh and estuarine fishes have been recorded from Big Fresh Creek: Carp, **Cyprinus carpio;** yellow bullhead, **Ameiurus natalis;** eel, **Anguilla rostrata;** dotted silverside, **Menidia menidia;** banded killifish, **Fundulus diaphanus;** mummichog, **Fundulus heteroclitus;** sheepshead minnow, **Cyprinodon variegatus;** mosquitofish **Gambusia affinis;** white perch, **Morone americanus;** chain pickerel, **Esox niger;** largemouth bass, **Micropterus salmoides;** bluegill sunfish, **Lepomis macrochirus;** and the pumpkinseed sunfish, **Lepomis gibbosus.**

Here is an example of what the ability to adapt means to animals. By adjusting to a wide range of environmental influences, vast new horizons may be open to them, thus helping to insure their continued survival and abundance. — R. J. BEHNKE.

INITIAL REQUEST FOR SALTONSTALL-KENNEDY FUND REJECTED

(CONTINUED FROM PAGE 1)

Three-Quarter Million Dollars In Duties on Crab Meat

one in view of the fact that Saltonstall-Kennedy funds are derived from tariff duties levied on imported fishery products. Thirty per cent of the total duties up to a maximum of $3,000,000 annually is set aside for this purpose. These duties on Japanese crab meat totaled over $753,000 in 1955, of which $251,000 went directly into Saltonstall-Kennedy funds. The Committee has just received word that it would not be possible to appropriate any of these funds for crab research during the coming year as all funds available had already been allocated to other fishery research.

Saltonstall-Kennedy Limit Increased

A bill just passed by Congress, has increased the former $3,000,000 limit. Now that more funds are available, the industry should be prepared to increase their efforts to obtain the financial support for these investigations. — D. G. CARGO.

STAFF CHANGES AT SOLOMONS

(CONTINUED FROM PAGE 3)

catch record system, has been appointed as Administrative Assistant. He will conduct the business affairs of the Department and assist the Director. Mr. Hensel became acquainted with many of the commercial fishermen of Maryland through his work with the catch record system.

Mr. George J. Murphy has been appointed as Fisheries Record Analyst to replace Mr. Hensel. Mr. Murphy has a degree in Biology from Loyola College in Baltimore. He has had wide clerical experience involving the collection and maintenance of statistical records.

Mr. Hayes P. Pfitzenmeyer has been appointed as Biologist III to work in the research program dealing with the soft clam and hydraulic dredge. Mr. Pfitzenmeyer has a degree of master of science from Pennsylvania State College and experience in several fields of research.

Mr. Earl T. Walker has recently resigned from the Department to accept a position as Biologist with the River Basins Studies Program of the U. S. Fish and Wildlife Service at Salt Lake City, Utah. Mr. Walker has been investigating the sport fisheries of Maryland and evaluating the hatchery system which Maryland has conducted for many years.

The advancement of Mr. Mansueti and the resignation of Mr. Walker leaves two openings as Biologist II in this Department. This position requires a masters degree in the biological sciences or experience in related research. Interested candidates can obtain further information and application blanks by contacting this office, or from the Commissioner of Personnel at 31 Light Street, Baltimore, Maryland.

It is regrettable that Maryland has to lose men of established ability with experience in local problems, but it is hoped that new staff members can be found who will make effective contributions to research on Maryland's resources. — L. E. CRONIN.

MARYLAND TIDEWATER NEWS

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EDITORIAL STAFF: D. G. CARGO, H. J. ELSER, G. F. BEAVEN, & J. R. LONGWELL.

Volume 13 SEPTEMBER—OCTOBER, 1956 No. 3

SQUIRREL HABITS PROVIDE KEY TO BETTER HUNTING

Squirrel Activity Studied

A recent study of Maryland gray squirrels produced information of direct use by hunters. This investigation involved determination of the number of squirrels present in two experimental woodlots. One of the "census" methods used involved sitting quietly for 15 minutes in one of 10 observation posts in each woodlot and at the end of 15 minutes moving on to another post. The number of squirrels seen was recorded and these data were later used to estimate the number of squirrels present. However, there existed the possibility that the squirrels were frightened by the observer's arrival and gradually overcame their fright during the 15 minute observation period. If this were true more squirrels would be seen during the latter part of the 15 minute period than during the early part. In order to learn the length of time required for the

(CONTINUED ON PAGE 2)

A TRIP TO THE CALVERT CLIFFS

Down to the Bay

Our party turned off Route 2, just north of Middleham Chapel and followed a winding sand road down toward the Bay. The private road followed a small stream which had cut a narrow valley through the cliffs to the beach. On either side of the stream as it reached the beach, the cliffs rose abruptly to over a hundred feet in some places.

Miocene fossils

(CONTINUED ON PAGE 4)

SOFT SHELL CLAM INVESTIGATION INTENSIFIED

Clam Production Rises

Maryland's production of soft shell clams during the first quarter of the current fiscal year has averaged more than 18,000 bushels a month, an increase of 40 per cent over the corresponding period of last year. An increase of 37 per cent in the number of boats licensed to dredge closely parellels the increase in catch.

Study of Effects Upon Oysters and Aquatic Vegetation Stressed

The Department's research program, financed largely by a tax of ten cents a bushel on soft shell clams caught in Maryland, is currently being directed toward evaluation of the effects of hydraulic clam dredging on our other economically important Bay resources. With funds accruing to the clam research program during the first year of operations, a research vessel was acquired and outfitted for experimental hydraulic dredging. Instruments and methods for measuring transport and deposition of bottom sediments were developed and field tested. In early summer of this year a

(CONTINUED ON PAGE 3)

SIZES OF CRABS COMPARED

How Large Are Our Crabs?

We are often asked as we visit the various crab centers around the Bay, "How do our crabs compare

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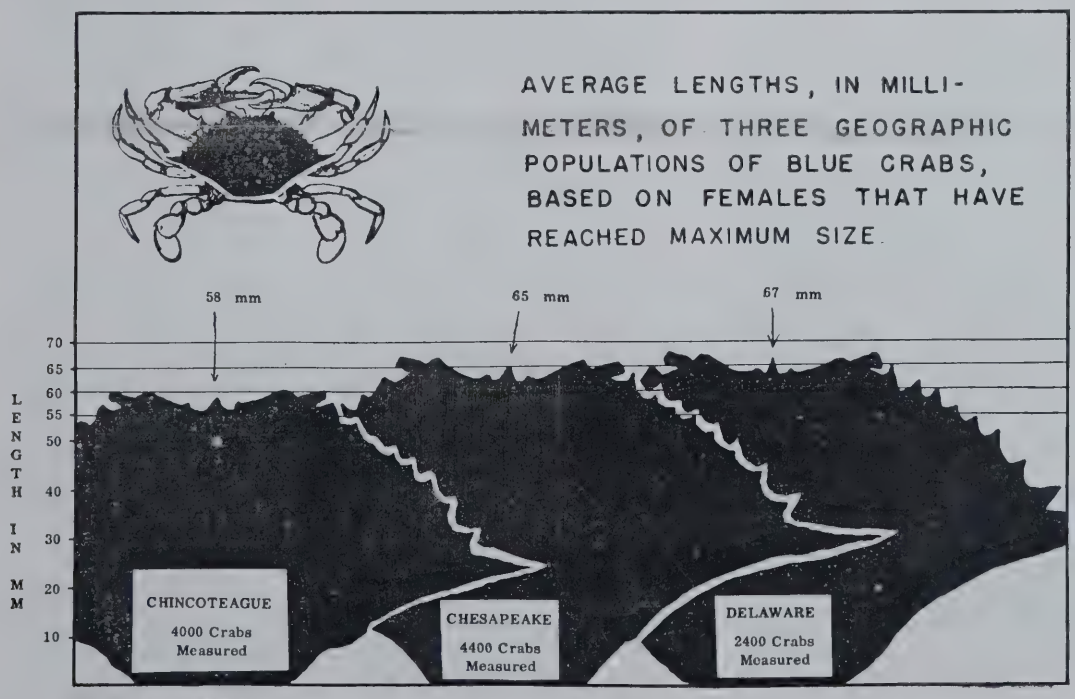


SIZE OF CALVERT COUNTY DEER HERD ESTIMATED

Animal Population Size Estimates are Difficult To Make

The question is frequently asked as to how many deer or rabbits or foxes or any other animal are present in a locality. This is a very difficult question to answer without expending a great amount of time and effort. To count the number of deer in a county or to make a good estimate, with some knowledge of the error involved, would require a Herculean effort. An accurate census would require more man power and money than is usually available. Virtually no reliable techniques, unfortunately, are presently available for easily determining the size of animal populations in a particular area. It is, however, still possible to make an intelligent, rough estimate which may be of value, based upon information at hand and upon previous work by game biologists in other states. Knowledge of the following factors, in the case of deer herd size, will allow the biologist to make a rough estimate of population size: (a) number of deer previously stocked; (b) number of deer recently shot by hunters; (c) amount of available deer habitat and food in an area; and (d) other information on the general biology.

Calvert County Deer Herd Size is a Rough Estimate

If Calvert County is taken as an example, we have a small collection of information of varying degrees of reliability that can be used as a basis for estimating the size of the deer herd. Deer had been virtually absent in this County for many years and the present herd is the product of recent introductions. Records show that 8 deer were released in 1950 and 25 (22 males and 3 females) in 1952. Mr. Arthur D. Jones, Regional Game Warden, knows that more were released in earlier years but actual records are not available. Deer hunting was legalized in the County in 1954. Records show that 12 deer were shot in 1954 and 13 in 1955. A well known authority on wildlife, Dr. R. E. Trippensee, in his book entitled "Wildlife Management," has listed 15 areas where intensive deer studies have been carried on. The percentage of deer shot varied from 5 to 23 percent. Using these percentages we can very roughly estimate that our deer herd would be between 56 and 260 head. However, considering sex ratio and the age of deer shot the author's guess is that there are over 100 deer in the County.

Calvert County is Relatively Poor Deer Habitat

Calvert County is composed of relatively poor deer habitat. Although 53 percent of the County is forested, 46 percent of these forests are saw timber stands. These stands have a small amount of the food that deer require in the form of leaves and twigs of trees and shrubs. The undergrowth in these saw timber stands is made up largely of mountain laurel which is not a deer food. Some of the available dogwood, vibernum, and tree saplings may serve as food. The smaller stands of trees (the remainder of the forest which is 54 percent) produce more browze than do the larger stands. Honeysuckle that is abundant in some areas is an excellent food. Crop land covers 17 percent of the County. A high percentage of this is tobacco which does not supply much deer food. Crops such as corn and other grains may, however, contribute to the food supply. Eleven percent of the County is pasture land which can contribute a certain amount of deer food. The remaining 19 percent of the County is non-food-producing since it consists of water, roads, lawns and marshes. The total area of Calvert County is approximately 245 square miles of which 130 square miles are forested.

Available Food Affects Size of Deer Herd County Can Support

The Calvert County deer herd is growing and the size of the herd will depend largely upon the amount of food available. Estimates for the number of deer per square mile of forest land, based on Dr. Trippensee's summary, ranges from 10 to 30 animals for poor to fair habitat. Based on this, Calvert County's 130 square miles of forest land could support roughly between 1,300 and 3,900 animals. Since deer reproduce slowly and because of the great number of stray dogs which can be serious predators, it may be many years before the deer herd reaches the maximum figure. The reader should bear in mind that these figures on deer numbers are purely speculative but they are perhaps the best we can do with the available information. The various estimates given above exemplify the many difficulties inherent in determining the size of animal populations. Biologists have a critical need for reliable estimates hence much future research will be devoted to this field.—V. F. FLYGER.

SQUIRREL HABITS

(CONTINUED FROM PAGE 1)

squirrels to overcome their fright the author recorded the length of time he had been sitting before the squirrels appeared.

Most Squirrels Seen the First Minute

Information was gathered on 109 squirrels. The results were surprising. Whereas we had expected to see most squirrels toward the end of the 15 minute period, the results showed that after the first minute squirrels appeared at a fairly constant rate throughout the observation period. However, about twice as many were seen during the first minute as during any other minute. This preponderance of squirrels seen during the first minute is probably due to the squirrels being stirred up by the movement of the observer into the area. It is therefore concluded that, except for the first minute, a person who remains quiet has little effect on the activity of squirrels in the general vicinity.

Moving Quietly Pays Off

These results are of interest with respect to hunting methods. In general there are two methods of hunting squirrels. One method is to select a likely looking spot and sit quietly for up to half an hour or more (15 minutes is about average) hoping to see a squirrel and get a shot at it. The other method is to walk quietly through the woods pausing briefly here and there at likely looking spots or at signs of squirrel activity, but moving on if no squirrels are seen within a few minutes. Therefore, since most squirrels are seen during the first minute, the man who moves about gets many of these first minute observation periods as well as covering more ground. The most productive hunting, however, is sitting near a tree in which the squirrels are actively feeding. If squirrels are not feeding in such trees, the next best method is probably to move about pausing briefly here and there.—V. F. FLYGER.

MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION, Chesapeake Biological Laboratory, Solomons, Maryland, L. Eugene Cronin, Director. Extract from the *Maryland Tidewater News*, Vol. 13, No. 3. Supplement No. 11, Sept.-Oct., 1956

Termites Of The Sea

By Romeo Mansueti

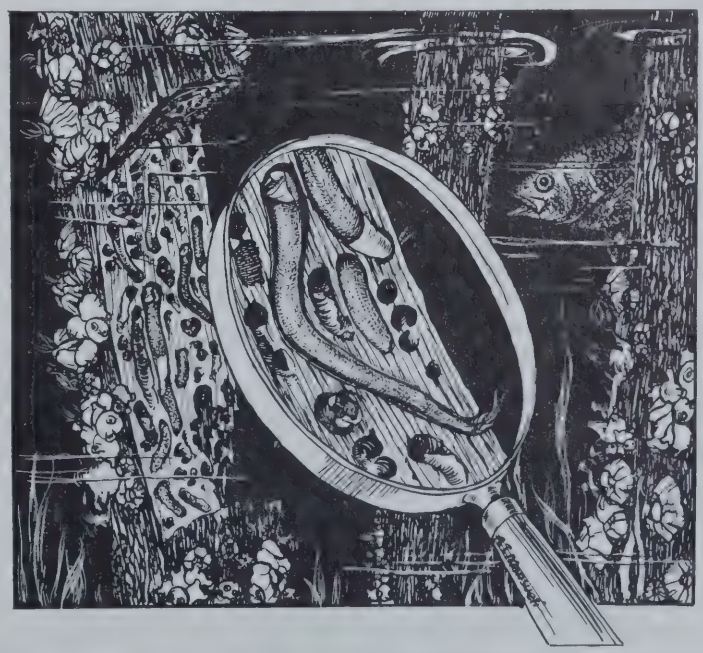
WHEN Captain John Smith explored Chesapeake Bay in 1607, he sailed for the upper tidal fresh waters to rid his vessel of a great and omnipresent nuisance—shipworms. He was following the time-honored custom of anchoring or sailing for a relatively long period in fresh water which killed most of the marine fouling organisms that were attached to or impregnated in the boat bottoms. The memory of the destruction of Sir Francis Drake's famous ship *The Golden Hind* by the insidious borings of shipworms must have preyed on Smith's mind on his voyage. Since the days of ancient Greeks and Romans, these creatures have been feared for the great destruction they cause to all immersed timber on wooden ships and harbor works.

Local tidewater communities have found it to be the bane of their existence. Wooden bridges and piers were threatened by these animals before the advent of modern methods of treating wood. At Solomons Island near the Patuxent River mouth, the wooden pilings of a 500-foot bridge connecting it with the mainland were frequently breaking down from shipworm damage at the turn of the century. This caused some political concern among State and County officials as to who should undertake the costs of repair. A new bridge was constructed in a short time after much haggling between the officials, but it, too, was ruined shortly afterwards even though the finest timbers had been used. Trouble in subsequent years did not cease until the use of chemically-treated timbers.

The incident mentioned above, however, hardly compared to the terrible destruction caused by shipworm borings in the dikes of Holland in 1730 when they threatened the very existence of that country. A Dutch scientist made an important discovery during the crisis—the shipworm is not a worm, but is actually a bivalve mollusk, a close relative of oysters and clams.

Although steel ships and properly treated boat bottoms have nothing to fear from them in this day and age, the loss of $10,000,000 in the port of San Francisco between 1914 and 1920 as a result of the great spread of shipworms stimulated much research on the biology of these creatures. The destruction of various timbers, fishermen's stakes, crab floats, and other untreated wooden structures in the estuarine and marine waterways of the Atlantic seaboard, nevertheless, still amounts to a pretty penny each year. One authoritative estimate in 1946 placed the loss to waterfront timbers by shipworm activity in the United States at $55,000,000 a year. The careless person who uses wooden vessels in these waters should heed the warnings issued by scientists concerning species and habits of shipworms found in their waters. A little knowledge can go a long way in preventing damage from these "termites of the sea."

There are at least twelve species of shipworms found throughout the world, but along the Atlantic Coast, two species are abundant. The estuarine shipworm, known scientifically as *Bankia gouldi*, is the extremely abundant species of Chesapeake Bay waters. The naval shipworm, *Teredo navalis*, on the other hand, is restricted to high salinity waters at the mouth of Chesapeake Bay and along the Atlantic Coast, and is also a dominant and highly destructive species. The



DRAWING BY A. J. MANSUETI

Reprinted through the courtesy of THE SKIPPER MAGAZINE, Annapolis, Md., Vol. 16, No. 9, pp. 27, 31, 32, Sept. 1956

estuarine shipworm, incidentally, can drill burrows of a larger diameter and greater length than that made by the naval shipworm in the Middle Atlantic region. Thus a few estuarine shipworms can inflict greater damage, on the average, than a somewhat larger number of the other species.

The estuarine shipworm is found from Annapolis (rarely as far north as Baltimore in Chesapeake Bay), Maryland, south in the Bay and lower tributaries to the mouth in Virginia. Biologists at the Chesapeake Biological Laboratory found that the strike, or the invasion, of active larval shipworms in wood is continuous from the beginning of June to the end of October, although the peak usually occurs in July. Spawning begins in May when the average water temperature is about 65°F. The distribution and intensity of strike decreases as the salinities decline up the Bay. It is found in estuarine water ranging from one-third to about nine-tenths the salinity of the open ocean. This species causes considerable damage in the Solomons area during summer. For example, in a 2″ x 4″ x 6″ wooden panel, submerged from May to early August, 1953, a total of twenty-two shipworms were found, ranging from one-half to twelve inches in length.

Most driftwood on the beach exhibits shipworm damage in the form of vast numbers of shell-lined tubes in which these elongated clams live. An active infestation results in a greatly weakened wooden structure that disintegrates or partly collapses when any strain is placed on it. The irony in the presence of these mollusks is that most people never know that the worms are raising havoc within their untreated boat hulls or piers.

An underwater reconnaissance with a face-plate and snorkel by a swimmer will reveal virtually nothing about the shipworm activity. The only evidence of their occurrence in an untreated wood piling is the presence at the hind end of the animal of siphons and of very small feather-like plates called pallets that project into the sea. The siphons are openings that allow water currents to flow in and out of the shipworm's innards. If a swimmer pokes or tickles the siphons, they are drawn back immediately behind the pallets. The latter, in turn, are pushed forward so as to close the pinhead-size opening of the burrow. Early explorers and mariners usually did not know of or could not cope with this clever action. Consequently, going into drydock or fresh water for periods less than several weeks, is not effective in killing the marine borers, for water can be retained within the burrow for long periods so that the animals are able to survive even after the wood has been out of water for several weeks.

Furthermore, a shipworm is a permanent prisoner in its home. It cannot leave its burrow or swim from one wooden structure to another. In fact, if it is cut from the wood, it is helpless and unable to form another burrow. How such a seemingly immobile creature can create such devastation on waterfronts and consternation among mariners is the most peculiar aspect of this animal's life cycle.

Shipworms have the power of locomotion for only a few weeks out of their lifetime, and that lasts probably no more than one year. At this time they are spread far and wide and invade all the suitable wooden structures with which they come in contact. Prior to this stage, the sexual products, eggs and sperm, are discharged during the summer months into the bays and seas in prodigious numbers through one of the siphons. The eggs are fertilized and the hatchlings develop into bivalve larvae with two shells or valves enclosing the body. Shellfish biologists find that larval shipworms taken in plankton collections are difficult to distinguish from other bivalve larvae such as oysters and clams.

Larval shipworms swim freely by means of rapidly-moving, hair-like projections called cilia. If water movements carry them by chance to untreated lumber, there they remain, the process resembling somewhat the setting of oysters on an oyster bar. Wood apparently exercises some form of chemical attraction for young shipworms, whereas other surfaces do not, for the borers will not remain on stone or steel surfaces. Once they have settled on wood, their body begins to change. They crawl about for a short time with the aid of a newly-formed foot, apparently seeking a suitable place to bore. Usually entering the wood at right angles to the grain, they soon turn in the direction of the grain. Shortly after attachment, the body elongates in a worm-like shape, and both shells and foot begin to take on the shape of an adult shipworm. As the body increases in size, the burrow becomes longer, and the bivalve soon earns its "termite of the sea" appellation. Incidentally, as they grow, shipworms can change sex from males to females. The most remarkable thing about burrows is that they never run into one another, even in densely riddled sections. X-ray photographs have shown such burrows to turn, twist and interlace with one another.

The shipworm bores by a curious rocking movement with the mechanical action of the blade-like portions of the shells in the head region. Wood is gripped by the foot which acts as a sucker, while at the same time a flap of skin which overlaps the shells grips it above. The shells are thus pressed firmly against the wood, and by muscular action the front lobes of the shells are drawn apart to scrape off the surface of the wood at the end of the burrow. Further complicated scrapings go on over and over again until the animal has twisted its body completely around, 180° in one and 180° in another direction. This action results in a burrow that is perfectly smooth and circular.

The fragments of wood are swallowed and ejected into the sea through one of the siphons. During this passage through the length of the gut some of the usually indigestible cellulose in the wood is digested by the shipworm and converted into energy-building sugars. The power of breaking down this plant substance is rare in the animal kingdom, and, coincidentally, occurs only in genuine termites and certain snails.

For all its menacing nature, the shipworm teaches us a few interesting lessons. There is no better example in the sea of the remarkably efficient way in which an animal is adapted to its strange mode of life. How many such lowly aquatic invertebrates have influenced and turned the tides of human history through the relentless and virtually invisible activity as have the shipworms? The development of creosoted-impregnated wood, anti-fouling paints with poison compounds of copper and mercury, and other measures, have proven fairly effective against shipworms, but they have far from eliminated the great annual damages that inflict maritime interests today.

Gourmets have looked into the shipworm problem, and the few reports that exist indicate that the flesh is edible and flavorsome. I have eaten a few raw shipworms removed alive from their wood-enclosed confinement after laborious efforts. Their flavor was typically that of raw shellfish, reminding me of a taste intermediate between oysters and hardshell clams on-the-half-shell. One removed from a pine log, however, had a distinctly piney flavor. Considering shipworm physiognomy, habitat, and the problem of harvesting them, there does not appear to be much promise in "termites of the sea" for widespread eating purposes.

SOFT SHELL CLAM INVESTIGATION INTENSIFIED

(CONTINUED FROM PAGE 1)

full-time clam biologist and two summer assistants were added to the staff of the laboratory. Intensive effort has since been directed toward measurement of the effects of hydraulic clam dredging on oysters, Maryland's most important seafood resource, and on the aquatic vegetation which occurs in shoal areas of much of our tidewater.

Planned Experiments Underway in Certain Areas

Effort has been concentrated in the Eastern Bay area, where the most serious conflict has developed between clamming and oystering interests. A full-scale experiment has been set up which, it is believed, will furnish definitive evidence on (1) the extent to which bottom sediments are displaced by hydraulic clam dredging and (2) the effect of such displacement on oysters. Results of this study will be reported in January 1957. Experiments also are in progress which should afford a sound basis for evaluating the effects of hydraulic clam dredging on aquatic vegetation. Progress on this phase of the investigation will also be reported in January.—J. H. MANNING.

CRABS EAT SEA SQUIRTS OR MOLGULA

Sea Squirts or "Blisters" A Pest to Oystermen


SEA SQUIRTS

A familiar sight to watermen are oysters and shells heavily coated with grape-like, rubbery brown spheres that squirt out streams of water when touched or squeezed. Various names such as "blisters" or "toad eggs" are given to the organism which actually is an animal fairly high in the scale of life and known to the biologist as an ascidian called **Molgula manhattensis.** Their ability to squirt out fine streams of water gives them the widely used common name of sea squirts. While they seldom cause harm to adult oysters, they sometimes coat them so heavily that the oysters are more difficult to tong or dredge up, and they also create a messy accumulation when they form a large portion of the oysterman's catch. On shells planted to "catch" young "oyster spat" the sea squirts may cover up most of the available surface so that oyster larvae are unable to attach. Later the sea squirts die and disappear. On a given bed they may be very abundant one season and can scarcely be found at all during other years.

Confined Crab Eats Hundreds of Squirts

Little is known of the animals that prey upon sea squirts and utilize them for food. The watery body and rubbery texture of **Molgula** would appear to make it unappetizing to most creatures. Similarly, there are gaps in our knowledge of the feeding habits of the common blue crab that is abundant in our waters. An observation has just come to light, however, concerning a small blue crab eating hundreds of squirts in a relatively short time. This occurred in a closed tray of one inch mesh that contained young oysters held at Solomons for growth measurements. The tray had been overboard undisturbed from May 21 to July 17, with bottom and sides lined with quarter inch mesh plastic screening. A number of similar trays were suspended beside it for the same period. When the trays were lifted all but one of them were found to be densely coated inside and out with hundreds of young **Molgula** about a half inch in diameter. These also thickly clustered on each oyster in the tray. The inside of one tray was found to be completely free of **Molgula** and was as clean as though it had been scrubbed. This mysterious condition was quickly explained. A young peeler crab had squeezed through the top of the tray, molted, and formed a new hard shell. Having grown in this process to a size of about three inches, the crab had been unable to get out. For food he had eaten up every **Molgula** that he could reach and cleaned all of the barnacles from the tray and from the oysters. There also were shell fragments of small clams that apparently had entered the tray and been captured. Although blue crabs are known to eat young oysters, none of the oysters were damaged. Apparently this crab was satisfied with the diet described for he was lively and scrappy. It is not known to what extent crabs may eat the sea squirts when they are free to roam and seek other food, but it would appear that the sea squirt is at times an acceptable item of food.—G. F. BEAVEN.

THE UNDERWATER SCENE VIEWED

Bay is A Summer Feeding Ground

Diving with face mask and "snorkel" in early summer near the Laboratory gives one a view of the underwater scene which seining could never do. Since the water is still clear, one can observe the undisturbed actions of the animals at quite some distance. Summer is a feeding and growing time in the Bay. Schools of diminutive spot scour the bottom for food, clouds of tiny silversides flit near the surface while disciplined ranks of young menhaden wheel with astonishing precision, their mouths agape. It is a thrilling experience to be able to swim leisurely thru this busy scene practically unnoticed. A small blue crab may be busily opening and devouring a clam while baby spot dart in to grab any scraps, and silversides swim back and forward above the scene picking up the even tinier pieces of clam that drift off from the feast. Juvenile needlefish lie like blades of eel grass at the surface, blurring into swift action as they catch an unwary silverside which has strayed from the school.

Toadfish and Blennies Guard Eggs

At this time of year also, the toadfish are at their noisiest and the diver's ears are assailed with what might be described as a tugboat convention. The toadfish are easily located in cans and jars and under logs and debris brooding over a batch of large yellow eggs glued to some hard surface. Blennies peek warily from empty oyster shells where they recline on their sides as they guard the eggs which line the shell.

Widgeon Grass Used As Hiding Place

The widgeon grass beds harbor the young pipefish, sticklebacks lurk among the stems, and the helpless soft crabs await a variety of fates from dip nets to greedy brethren. Young summer flounders undulate away across the clear patches in the grass to settle again with a little flutter that sifts sand grains over their edges to obliterate all but the eyes. Out of the corner

(CONTINUED ON PAGE 4)

SIZES OF CRABS COMPARED

(CONTINUED FROM PAGE 1)

with those from other areas?" This question is not as easy to answer as it sounds. One could, of course, obtain a few crabs from other states and measure them but a little thought coupled with some experience brings forth several problems. To make this comparison properly, the crabs should be of the same age or should have passed through the same number of molts. The adult female or "sook" answers this question nicely and one of the problems is solved since we can recognize the mature crab and are fairly certain that the crabs have reached their maximum size and have undergone a similar number of molts. A second difficulty results from seasonal, regional and perhaps other effects on the variation in the average size of the crabs. Many areas report a great number of small females at certain times during the year. In Chincoteague Bay for example, small adult females sometimes account for more than 50 per cent of the catch during the fall. Miles River, on the other hand, has a population of large male crabs throughout most of the season. These situations have not, as yet, been completely explained. We can, however, report on the progress that has been made toward answering the question above.

Atlantic and Gulf Coast Crabs Measured

During the last three years, samples of crabs have been collected from different estuaries along the Atlantic and Gulf Coasts. Many persons and institutions have assisted us by providing specimens for measuring. In this study we have used the length of the shell of the crab from the point between the eyes to the back edge of the shell. Our measurements are in millimeters, and there are about 25 of these to the inch.

Average Length of Crabs from Atlantic Coast Estuaries

Location	Average Length mm
New Jersey	58.4
Chincoteague Bay, Md.	58.5
New York	58.7
Florida	62.7
North Carolina	64.4
Chesapeake Bay	64.8
Louisiana	66.6
Delaware Bay	66.9

Delaware Crabs Largest

A glance at the graph will show the average size of three large groups of these adult females from various areas. The crabs from the Chesapeake were among the largest but do not equal those from Delaware Bay. Each sample includes specimens caught at different places and times in the estuary, and it is felt that the figures are fairly accurate. It should be pointed out that the averages from Chincoteague Bay, Chesapeake Bay and Delaware Bay are based on a large number of measurements. The other areas have not been as thoroughly sampled and the data are, therefore, not as reliable. However, it is felt that the sampling does indicate the general size which is present in those areas. These differences may not seem large, but if you will remember that these are the averages of large numbers of crabs, their importance will be apparent. The reasons for these differences in size have not been determined but will be the object of continuing study in the months ahead.—D. G. CARGO.

THE UNDERWATER SCENE SEEN

(CONTINUED FROM PAGE 3)

of his eye the diver can see a wary eel slipping away thru the grass or hiding in the debris which has drifted into the depression left by a clam-digging cow-nose ray.

Everyone, An Underwater Naturalist

The wonders are endless in this underwater world and with a very small investment in a mask and snorkel anyone can be a part of this fascinating place even if he cannot swim very well, since all the activities described here can be seen in three to four feet of water in most shore areas of the mid-Bay region. — E. T. WALKER.

A TRIP TO THE CALVERT CLIFFS

(CONTINUED FROM PAGE 1)

Cliff Erosion Discloses Fossil Secrets

Standing on the beach and looking up at the face of the almost perpendicular cliffs, we had an excellent example of the tremendous amount of erosion that is caused by the storm-driven waters of the Bay. The water had cut into the base of the cliffs leaving tons of unsupported material to crash to the beach in great heaps. In some places the masses of material had been washed away, while those more firmly solidified had withstood the onslaught of wind and water. Where the beach had been washed clean, the sheer face of the cliff was exposed showing the various strata defined clearly by different colors. Also exposed were millions of fossil shells. Even though the erosion is a boon to the hunter of shark's teeth or other fossils, it is a never ending concern to the land owner who sees the Bay eating his land away foot by foot.

Into the Past

We turned south toward Point of Rocks and walked slowly, watching for shark's teeth or what ever might prick the interest. Imaginations, inspired by the great quantities of fossils, turned back to the Miocene period to look at the type of life that existed between fifteen and twenty million years ago. Using actual findings as a basis, one could imagine the great whales, the vicious sharks, and huge rays swimming about over what is now Calvert County. No doubt there were crocodiles and as many as five different families of turtles in the lagoons. In waters protected from the sharks, the manatees and porpoises swam. At the bottom, coral, oysters and huge barnacles lived. Numerous types of snails lived along with the other animals and the ancient crab. On the shore the ancestors of the gannet and other birds made their homes. There were trees and other plants, too; such as the ancient walnut and pine.

Not For Paleontologists Alone

One becomes so engrossed in fossil hunting that even the present has a way of passing by unnoticed, as well as the miles under foot. The fascination of collecting becomes so great that the new visitor does not discriminate but departs loaded down as were the members of our party. The sharks' teeth usually have priority and are kept in the safest pocket; other pockets are then loaded with coral, scallop shells, clam casts, bits of dense iron, huge barnacles, snail casts and sand dollars. The three hours allotted for our hunt had passed all too quickly. Indeed, one does not have to be a paleontologist to enjoy the Cliffs of Calvert.—K. F. SANDERS.

MARYLAND TIDEWATER NEWS

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EDITORIAL STAFF: D. G. CARGO, H. J. ELSER, G. F. BEAVEN, & J. R. LONGWELL.

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L. Eugene Cronin, Director

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MARYLAND FORESTRY OBSERVES GOLDEN ANNIVERSARY

A Pioneer State In Forest Survey

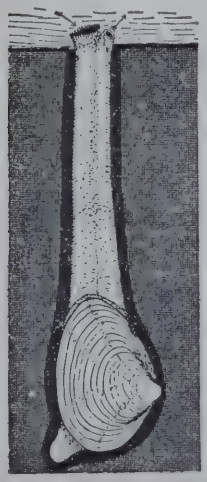
This year conservationists in Maryland are pausing to look back upon the accomplishments of forestry within the State durin the past 50 years. They are also paying tribute to those who pioneered good forestry practices. Forestry in the United States was just beginning to develop as a profession when Robert and John W. Garrett of Baltimore decided that it was time for conservation to make its start in Maryland. In 1905, they offered 2,000 acres of forest land to the State, provided that adequate care was taken of the area. The direct result was the creation of the State Board of Forestry in 1906. The gift from the Garrett Brothers became known as the Swallow Falls State Forest, which today is considered one of the most scenic spots in Maryland. The first State Forester was Fred W. Besley, a graduate of the Yale School of Forestry. His first task was to determine the forest conditions and needs of Maryland. This imposing job, started in 1907,

(CONTINUED ON PAGE 3)

SOFT CLAM SET OBSERVED AT SOLOMONS

Clam Life History Study In Progress

The recent development of a valuable clam fishery in Maryland has served to focus attention upon the relatively unexplored life history of the soft shell clam, **Mya arenaria,** in the Chesapeake Bay region. Knowledge of the biology of this mollusk lags far behind



that of other commercially important resources of the Bay. An early investigator, John A. Ryder, observed in 1880 that the Maryland soft shell clam spawned from about the middle of September until the middle of October. Very little work has been done on this phase of the clam's life history since Ryder's observations. At present a study of the spawning and setting of our native bivalved mollusks, and particularly the soft shell clam, is in progress at Solomons.

Spat Traps Reveal Setting

Weekly and biweekly samples of set are collected. These, together with plankton samples, are revealing

(CONTINUED ON PAGE 2)

ANALYSIS OF POND FISH POPULATIONS SHOW INTERESTING VARIATIONS

Sand's Pond Recently Studied

Sand's Pond, a 10.5 acre lake in Cecil County was drained on October 15th and a complete picture of its fish population obtained. The project was conducted jointly by the Maryland Departments of Game and Inland Fish, and of Research and Education. All fish leaving the pond as it was draining were caught in a wire mesh cage constructed below the spillway. The fish were turned over to a group of biologists and their helpers who measured, weighed and took a sample of scales (for determining age) from a representative sample of the population.

Number of Fish and Weight Tabulated

Results show that the greatest poundage of fish flesh was in European carp. However, because they ran to such large sizes, there were not many individuals taken. The following table presents the number of individuals of each species found, the number of pounds collected and the percent of total weight made up by each kind.

(CONTINUED ON PAGE 4)

WIND GAUGE INSTALLED AT SOLOMONS ISLAND

Need for More Accurate Over-Water Observations

Hurricanes that have visited the Chesapeake area during recent years have pointed up the need for more accurate measurements of wind velocity over water areas. To help obtain the desired data, the U. S. Weather Bureau, with assistance from the Maryland State Weather Service, has installed an accurate electrical anemometer on a steel mast at the end of the Laboratory Pier at Solomons. This device, located about 735 feet out from the shoreline, is connected by an electric cable to a continuous recorder in the Laboratory building. Data concerning peak, sustained and average wind velocities, together with wind direction, will be compiled for studies of storms that effect this area.

Solomons A Key Climatological Station

Official records of daily maximum and minimum temperatures, precipitation, and destructive storms have been gathered by cooperative observers at Solomons since 1891. The late Dr. Marsh was the Solomons observer for one of the longest continuous terms in

(CONTINUED ON PAGE 3)

DEER CHECKING RECENTLY COMPLETED

Nine Stations Manned

Biologists and game technicians have just completed the examination of deer at nine checking stations in Maryland. The following stations were manned on December 3rd and 4th, the first and second days of the season:

Oakland, Garrett County	Harold Elser
Grantsville, Garrett County	Harold Elser
Green Ridge, Allegany County	Hayes Pfitzenmeyer
Hancock, Washington County	Dale Sheffer
Lewistown, Frederick County	Phil Lines
La Plata, Charles County	Craig Whitesell
St. Leonard, Calvert County	David Cargo
Aberdeen, Aberdeen Proving Ground	Eugene Cronin
Northeast, Cecil County	John R. Longwell
Newark, Worcester County	V. F. Flyger

Mr. Lines and Mr. Sheffer are both employees of the Game and Inland Fish Department.

Age and Weight Important

The most important data gathered were the age and weight of the deer. This information reflects the general condition of the deer in various portions of the State. For the results of last year's deer check see the June 1956 issue of the **Maryland Tidewater News.**

This year impressions were made of the deer teeth. Plaster casts are being made of these teeth in the Laboratory and the ages of the deer will be determined from these casts. This technique was tried experimentally during last year's deer season and with improvements was used with great success this year. By employing this technique in following years, it will not be necessary to use trained biologists at the checking stations.

General Physical Condition To Be Studied

In addition to the age and weight, blood smears were made and an attempt was made to gather adrenal glands. The blood smears will be examined for the presence of parasitic protozoa and worms and the adrenal weights (if enough can be accumulated) may indicate the general welfare of the animal.

(CONTINUED ON PAGE 4)

BIOLOGIST HAROLD J. ELSER HOLDS A CLAY IMPRESSION OF LOWER JAW TEETH OF A DEER. A PLASTER OF PARIS MOLD WAS MADE FROM THIS FOR AGING PURPOSES IN THE LABORATORY.

ANNUAL TEACHERS WORKSHOP PLANNED FOR SUMMER 1957

Western Maryland College Will Be Center For Classes

The Workshop, teaching Conservation of Natural Resources, will be held at Western Maryland College, Westminister, during the regular 1957 summer school session. The course, scholarship sponsored and open only to Maryland school teachers, will offer six hours of graduate credit. Two levels of scholarships are available: (1) $226.00 for boarding students, and (2) $151.00 for day students. Teachers who wish to receive a scholarship should write for an application form to Dr. Joseph Bailer, Department of Education, at the College. A basic requirement set forth by the scholarship committee is that each teacher selected for a scholarship must have the recommendation of his county superintendent.

Field and Laboratory Work Will Be Featured

More than 2,000 miles of travel have been planned to include local trips in Carroll County to study soil, water, forests, game and minerals; Excursions will include: (1) Two-day trip to Western Maryland counties, (2) Two days at the Chesapeake Biological Laboratory, Solomons, (3) Three-day trip around head-of-Bay and to Eastern Shore, Cincoteague Bay and the Atlantic Ocean, and (4) One day at the U. S. Weather Bureau, Friendship International Airport.

Many Agencies Support the Scholarship and Participate In the Workshop

The 1957 scholarship fund will be made available by a grant-in-aid from the National Wildlife Federation and contributions from the League of Maryland Sportsmen, Sportsmen's Clubs, Federated Garden Clubs of Maryland, Maryland Soil Conservation Districts, Rotary Clubs, Lion's Clubs and private individuals. The class will hear about Maryland's resources from persons who know and make conservation their life work. These lecturers and trip leaders will come from the Departments of the Maryland Board of Natural Resources, the U. S. Soil Conservation Service, the Maryland Water Pollution Control Commission, the

(CONTINUED ON PAGE 3)

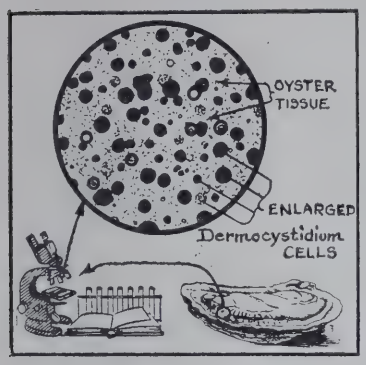
SOFT CLAM SET OBSERVED AT SOLOMONS

(CONTINUED FROM PAGE 1)

many interesting facts on the life histories of our estuarine bivalves. The spat traps used are metal trays one inch deep and fourteen inches in diameter. They are filled with clay which has been screened through a 250-micron (.0098 inch) sieve. Each week two of these traps are placed on the bottom in six to eight feet of water beneath the laboratory pier. At the end of one week's and two weeks' exposure they are removed from the water and replaced by new traps. The clay is then washed through the 250-micron sieve and the spat larger than 250 microns are retained in the sieve. Many spat other than **Mya** have been collected and are being studied. However, **Mya** set has consistently been the most numerous since appearing the week of September 17-24. Spat of this species in the 300-500 micron length range appeared in the trap exposed during the week of November 19-26. Apparently the season of reproduction is considerably longer than previously believed. However, only continued sampling, which is anticipated on a year-long basis, will give definite results.—H. T. PFITZENMEYER.

OYSTER PARASITE DISTRIBUTION STUDY CONTINUED

Survey Started In 1955



During the summer of 1955, a study of the distribution of the oyster parasite, **Dermocystidium marinum,** in Maryland was begun. The study has been continued during this past summer and fall. **Dermocystidium** is a fungus parasite of oysters. Heavy infections cause the death of oysters while light infections cause slow growth and poor condition. It is harmless to man. (See **Maryland Tidewater News,** February 1956 for a more complete description of the parasite).

General Distribution Delineated

The 1955 survey showed that **Dermocystidium** is present in the more saline waters of Maryland on both sides of the Bay south of Cove Point. The heaviest infections have been found in Tangier Sound, Pocomoke Sound and the lower St. Mary's River. The infection level was high enough to cause some oyster mortalities in these areas.

Infections Lighter This Year

The survey this year has shown **Dermocystidium** to be present in the same areas in which it was found last year but the infections are lighter. Research in other states indicates that high temperatures and high salinities favor the growth and development of the fungus. Thus these lighter infections are probably related to the lower salinities and water temperatures which prevailed this year during late summer when infections were building up.

Parasite Not A Serious Menace

Although the presence of **Dermocystidium** in Maryland oysters has been definitely established and its general distribution is now known there seems to be little cause for alarm. The parasite does cause the death of some oysters, especially in hot, dry years but it does not appear at present to be a major mortality factor in Maryland.—E. A. DUNNINGTON.

ANNUAL TEACHERS WORKSHOP PLANNED FOR SUMMER 1957

(CONTINUED FROM PAGE 2)

U. S. Weather Bureau and the U. S. Extension Service.

Workshop Has A Three-Year Record of Service

In the past three years, 65 teachers have been trained in the Workshop, with Baltimore City and all but two of Maryland's counties having representation. Letters received from these teachers during the last three years list the following results of teaching natural resources in classrooms: (1) Develops understanding of natural laws and processes and shows that natural resources are interdependent, (2) Develops skills in use of resources—production, processing, consumption, (3) Develops sense of civic and social responsibility, (4) Develops consciousness of human needs and resource-use problems, (5) Influences people in attitudes and behavior, and (6) Motivates people to observe, think and act.—B. L. Ashbaugh.

WIND GAUGE INSTALLED AT SOLOMONS ISLAND

(CONTINUED FROM PAGE 1)

the State during the early part of this period. Such records are the means by which the climate of an area can be documented and changes in climate shown. Urban growth and industrial air pollution are known to have caused marked changes in the climate of large cities such as Baltimore. Solomons, however, has remained stable in these respects so that it is one of the key points for observing true climatological changes that have occurred during its 65 years of record. Furthermore it is representative of the long Maryland shoreline adjacent to large bodies of water where extremes of temperature often are quite different from those found at nearby inland points.

Future Records to be More Comprehensive

In addition to the aerovane or wind gauge, there have been installed at the Solomons cooperative station a recording rain gauge, a hygro-thermograph and a sling psychrometer. These will produce records on the duration of temperature levels, the time and rate of precipitation, and the relative humidity. Climatological data are useful in studying the activities of all of our resources. They supply information useful to the farmer and to many other industries that are influenced by weather. The more complete recordings at Solomons not only will interest the climatologist but are utilized by the Laboratory in many of its studies, especially those of marine life.—G. F. BEAVEN.

MARYLAND FORESTRY OBSERVES GOLDEN ANNIVERSARY

(CONTINUED FROM PAGE 1)

required nearly seven years to be completed, and was the first survey of the forest resources of any state. Mr. Besley's report, **The Forests of Maryland,** was published in 1916 and included a detailed forest-type map of each State's 23 counties.

(CONTINUED ON PAGE 4)

A PINE PLANTATION

MARYLAND FORESTRY OBSERVES GOLDEN ANNIVERSARY

(CONTINUED FROM PAGE 3)

Maryland Foresters Honored

Following Mr. Besley's retirement in 1942, the position of State Forester was filled by Joseph F. Kaylor, now the Director of the Department of Forests and Parks. Serving with Mr. Besley as his Assistant Forester since 1916 was Karl E. Pfeiffer, now Assistant Director. Mr. Besley, Mr. Pfeiffer, and Mr. Robert Garrett were honored by Governor McKeldin, forestry officials and friends, at a dinner this year, marking the start of the celebration of the golden anniversary of forestry in Maryland.

Diversified Program Now In Effect

The Department of Forests and Parks now has charge of over 132,000 acres of land, of which over 90 per cent is in 10 State Forests and the remainder in the 14 State Parks. Its modern State Forest Nursery, presently increasing its annual production of seedlings from five million to 10 million, is capable of raising over 20 million seedlings each year. Forest landowners are now able to secure the services of State Foresters for marking their timber prior to sale, thereby insuring a well-managed woodlot as well as a high return from the timber that is sold. Less than one-tenth of one per cent of the State's forest land is burned over annually, a direct result of the development of an extremely efficient and effective fire prevention and control organization equal to any in the country.

Research Program Initiated

In 1951, a three-year State-wide Forest Survey was completed by the U. S. Forest Service in cooperation with the Maryland Department of Research and Education. A forester was first employed by the latter organization in 1948 for the purpose of inventorying the State's forest resources. Since the completion of the State-wide Forest Survey, emphasis has shifted to forest research on such projects as the testing of exotic tree species, including geographic races, and tree improvement studies. Such studies are conducted on the State forests, in cooperation with the Department of Forests and Parks.

Maryland Honored By National Meeting

Recently the American Forestry Association, in recognition of Maryland's 50 years of forestry, held its 81st annual meeting in Charles County. Over 350 members from all sections of the United States viewed the forest practices of Southern Maryland and the research projects at the Cedarville State Forest. Demonstrations showed how the value of forests can be preserved and enhanced. These demonstrations included strip cutting, burning, underbush control, selective cutting, and charcoal manufacture from wastes. Maryland's forest products are estimated to be worth approximately 10 million dollars annually, with a wholesale value of 60 million dollars for the finished products. This income from the State's 2.9 million acres of forest lands can be materially increased as results of the research program become available and as more and more of our forest owners undertake good forest management practices.—C. D. WHITESELL.

ANALYSIS OF POND FISH POPULATIONS SHOW INTERESTING VARIATIONS

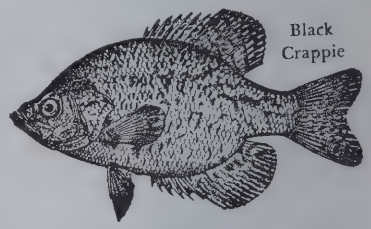
(CONTINUED FROM PAGE 1)

Species	Number Collected	Pounds Collected	Percent by Weight
Carp	216	1434	35.0
Bluegills	9292	1216	29.6
Largemouth bass	706	695	16.9
White suckers	76	234	5.7
Golden shiners	762	190	4.6
Brown bullheads	285	179	4.4
Black crappies	261	57	1.4
Eels	167	47	1.1
Chub suckers	15	21	0.5
Pumpkinseeds	243	13	0.3
White perch	18	11	0.3
Warmouth	77	4	0.1
Yellow perch	7	2	0.1
White crappies	1	19 ounces	*
Mudminnows	13	3 "	*
Yellowbelly sunfish	3	2½ "	*
Redfin pickerel	1	½ "	*
Mummichogs	3	½ "	*
Madtoms	1	½ "	*
Johnny darters	1	— "	*
	12,148	4,105 pounds	

* Less than .05 percent.

Good Fishing Not Dependent Upon Pounds Per Acre Present

Altogether, there were 391 pounds of fish per acre—the highest such figure for any Maryland lake so far studied. Smithville Pond in Caroline County, drained a year ago, showed a standing crop of 63 pounds per acre. Oddly enough, both these ponds enjoyed excellent reputations for fishing. Six other ponds for which adequate data are available show them to have had standing crops varying from 83 to 200 pounds per acre—yet none of these ponds were as satisfactory for fishing as either Sand's or Smithville. We may conclude from these figures that the success of fishermen is not dependent upon the pounds of fish present.—H. J. ELSER.


Black Crappie

DEER CHECKING RECENTLY COMPLETED

(CONTINUED FROM PAGE 2)

Deer At Aberdeen Examined

Particular attention is being given to the deer at Aberdeen Proving Ground because, at this place, the deer are brought to a central location to be eviscerated which presents an excellent opportunity to gather much information. These deer were autopsied in greater detail than at the other checking stations. The viscera were examined carefully for parasitic worms, and weights and measurements were taken of the internal organs. Pieces of organs were saved for study of their microscopic anatomy. The deer in this area exist under the most crowded conditions of any deer herd in the State. What we learn about them can be used as a yardstick for comparison with other Maryland deer herds. The data at present are being analyzed and a report of the results will be issued in several months. —V. F. FLYGER.

MARYLAND TIDEWATER NEWS

Entered as Second Class Matter at Solomons, Maryland. Office at Chesapeake Biological Laboratory, Solomons, to which all communications should be addressed.

EDITORIAL STAFF: D. G. CARGO, H. J. ELSER, G. F. BEAVEN, & J. R. LONGWELL.

 Published monthly by the Staff of the Maryland Department of Research and Education.

L. Eugene Cronin, Director

Volume 13 JANUARY—FEBRUARY, 1957 No. 5

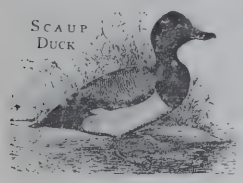
DUCK BANDING RESUMED AT SOLOMONS

Interest Centers On Scaup

The annual post-hunting season waterfowl banding program has again been resumed at Solomons. This banding, a joint effort with the Maryland Game and Inland Fish Commission and the U.S. Fish and Wildlife Service, was initiated by the Department of Research and Education at the request of the Atlantic Waterfowl Council primarily to assist in the banding of large numbers of both greater and lesser scaup (blackheads or bluebills).

Many Ducks Banded Previous Three Years

Beginning in 1954 and proceeding through 1955 and 1956 a large number of ducks have been trapped at Solomons. Not only are all ducks banded and released unharmed, but also information concerning sex, age and weight have been recorded for those captured. The totals to date show that 1,086 scaup, 32 greater scaup, 209 red-



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SETS OF COLORED SLIDES PRODUCED FOR SCHOOL USE

Over 45,000 Slides Placed In Schools

During the last four years, the Department of Research and Education has prepared sets of Kodachrome slides and accompanying texts on various Maryland resources. These teaching materials are duplicated and sold at cost.

Eleven Subjects Are Covered

The titles and a brief description of each set of slides follow:

1. Seeing Maryland—72 slides and 52-page text describing Maryland agriculture, mining, forestry, wildlife and scenery, including the "Seven Natural Wonders of Maryland."
2. The Blue Crab—20 slides showing crab specimens and industry.
3. The Oyster—20 slides of oyster industry and life history.
4. Commercial Fish—14 slides of major commercial fishing gears.
5. Maryland's Inland Resources—24 slides on surface water, soil, forests, fish and game.
6. Wildflowers. Set I—32 species illustrated.

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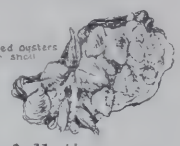
SHELLFISH STUDIES CONDUCTED BY LABORATORY

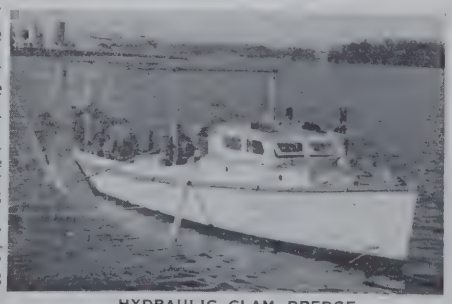
Personnel Cover Three Fields of Work



The current shellfish research program of the Maryland Department of Research and Education falls into three general divisions. (1) Studies of the soft shell clam **(Mya arenaria)**, and of hydraulic clam dredging, constitute the full time program of two biologists of the Chesapeake Biological Laboratory at Solomons. (2) Oyster studies in the Chesapeake area are conducted by two other biologists of the Laboratory staff who are assigned to this work on an approximate half time basis. (3) Oyster studies in the Chincoteague Bay area constitute the major portion of the program of a resident biologist stationed at the Department's field laboratory in Worcester County. Certain phases of the research program are conducted jointly by the above divisions, and there are several cooperative projects with personnel of the Department of Tidewater Fisheries and of the U.S. Fish and Wildlife Service Laboratory at Annapolis.

Effects of Hydraulic Clam Dredge Studied

Present emphasis in the soft shell clam program deals with the effects of hydraulic clam dredging upon the bottom structure, upon rooted marine vegetation, upon the oyster population, upon the clam population, and upon other associated organisms, especially those of economic importance. Experimental plots have been set aside in the Patuxent River and in Eastern Bay. Observations have been made by aerial photography, skin diving, glass-bottomed viewing boxes, direct observation of flats exposed by exceptional low tides, bottom cores, and by instruments for measuring turbidity and siltation. A modern commercial type hydraulic clam dredge is used for experimental dredging and gathering clam population data. Studies of spawning, setting and growth of **Mya** in the Chesapeake area are in progress, and a study of the effect of temperature upon pumping rates of the clam has been completed. A paper dealing with the effects



HYDRAULIC CLAM DREDGE

(CONTINUED ON PAGE 6)

SETS OF COLORED SLIDES PRODUCED FOR SCHOOL USE

(CONTINUED FROM PAGE 1)

7. Wildflowers. Set II—25 additional flowering plants of Maryland.
8. The Plant World—25 slides illustrating the major plant groups of the State.
9. Animals with Backbones—25 slides showing fish, amphibians, reptiles, birds and mammals of Maryland.
10. Animals Without Backbones—25 slides on the major invertebrate groups of the State.
11. The Steel Industry of Baltimore—23 slides showing operations at Sparrows Point plant.

Catalog of Teaching Materials Available

Persons interested in the colored slides and other teaching materials should write to the Board of Natural Resources, 100 College Avenue, Annapolis, Maryland, for a catalog.—B. L. ASHBAUGH.

MOURNING DOVE REPORT 1956 HUNTING SEASON

Most Wings Collected Early In Season

During the early part of the 1956 Dove season, a number of wings were collected to be used in the aging study that has been conducted by this Department for the past seven years. Through the cooperation of game wardens and wildlife field superintendents of the Maryland Game and Inland Fish Commission, dove hunters and personnel of this Department, a total of 785 wings was collected throughout the State. Most of these wings were collected during the first week of the season which began on September 15, and continued through November 8, 1955 (see Table 1). This time of wing collection provides the most useful data since wings of some juveniles collected late in the season exhibit only adult plumage whereas had they been collected earlier they would have been identifiable as juveniles. Hence, the maximum percentages of juveniles are evident during the first several days of the season.

Table 1

Date	Wings Collected		
	Adults	Juveniles	Total
Sept. 15 — Sept. 22	227	447	674
Sept. 23 — Sept. 29	1	13	14
Sept. 30 — Oct. 6	7	9	16
Oct. 7 — Oct. 13	6	4	10
Oct. 14 — Oct. 20	10	12	22
Oct. 21 — Oct. 27	3	5	8
Oct. 28 — Nov. 3	3	5	8
Nov. 4 — Nov. 8	8	14	22
Unknown	2	9	11
	267(34%)	518(66%)	785

Age Composition Compared By Area and Season

For examination, these wings were divided into two groups; those collected on the Eastern Shore and those collected in areas west of the Bay. The age composition of 590 wings collected from the Eastern Shore was 67 per cent juveniles and 33 per cent adults while the age composition of 195 wings from areas west of the Bay consisted of 63 per cent juveniles and 37 per cent adults. On a statewide basis the composition was

(CONTINUED ON PAGE 5)

NEW PUBLICATIONS ISSUED

A number of technical and educational printed pamphlets have been published by the Department of Research and Education since the last partial listing in the August, 1955, issue of **Maryland Tidewater News.** These include: (1) **Contributions,** the technical series primarily of interest to scientists, (2) **Educational Series,** a series of an educational or informational nature and (3) **Resource Study Reports,** semi-technical reports usually directed toward management problems.

Since the last publication of these lists, the following have been received from the printers:

New Contributions Issued

No. 102. MANSUETI, R. and RALPH PAULY. **Age and growth of the Northern Hogchoker, Trinectes maculatus maculatus, in the Patuxent River, Maryland.** Reprinted from COPEIA, 1956, No. 1, pp. 60-62, February 29. Describes the ages attained and growth rate of this flounder-like fish.

No. 103. SCHELTEMA, R. and R. V. TRUITT. **The Shipworm, Teredo navalis, in Maryland coastal waters.** Published in October 1956 issue of ECOLOGY, Vol. 37, No. 4, pp. 841-843. A description of the distribution and other pertinent characteristics of the shipworm in the Chincoteague—Ocean City area.

No. 104. RYAN, EDWARD P. **Observations on the life histories and the distribution of the Xanthidae (mud crabs) of Chesapeake Bay.** Reprinted from **The American Midland Naturalist,** Vol. 56, No. 1, pp. 138-162, July, 1956. Univ. of Notre Dame Press, Notre Dame, Indiana. A description of the distribution of these important small crabs in Chesapeake Bay.

No. 105. MANNING, J. H. and H. H. WHALEY. **Distribution of oyster larvae and spat in relation to some environmental factors in a tidal estuary.** Reprinted from the Proceedings of the National Shellfisheries Association, Vol. 45, August 1954, pp. 56-65. Results of research on factors controlling the distribution of oyster larvae in St. Mary's River.

New Educational Series Issued

No. 39. TRUITT, R. V. 1955. **Annual Report, 1954.** Reprinted from Eleventh Annual Report, Maryland Board of Natural Resources, 1954. 32 p. Annual reports will henceforth be listed separately and will not be included in this series.

No. 40. Maryland State Weather Service, Maryland Department of Research and Education, and United States Weather Bureau. 1956. Climatography of the United States, Number 40-18: **Climatic Guide for Baltimore, Maryland.** A summary of the climatical characteristics of Maryland's major city. Based on continuous records since 1817.

Resource Study Reports Issued

No. 8. BEAVEN, G. FRANCIS. **Various aspects of oyster setting in Maryland.** Reprinted from the Proceedings of the National Shellfisheries Association, Vol. 45, August 1954, pp. 29-37. Discusses problems involved in obtaining oyster sets in Maryland.

No. 10. MANSUETI, R. **Recaptures of tagged striped bass, Roccus saxatilis (Walbaum), caught in deep water of Chesapeake Bay, Maryland.** October 1956, pp. 1-9. Description of the tagging and recapture of deep water fish.

No. 11. MANNING, J. H. **The Maryland soft shell clam industry and its effects on tidewater resources.**

(CONTINUED ON PAGE 3)

LONGEST AND HEAVIEST FISH OF EACH SPECIES FOR WHICH RELIABLE RECORDS ARE AVAILABLE: FRESH WATER ONLY: MARYLAND, UP TO JAN. 1, 1957

(See text on preceding page)

GROUP	RECORD FOR*	SPECIES**	LENGTH (Inches)	WEIGHT Lbs.	WEIGHT Oz.	WHERE TAKEN	DATE	METHOD	TAKEN BY	DATA FROM***
PREDATORS	L	Largemouth Bass	27.0	6	3	Sand's Pond, Cecil Co.	Oct. 15, '56	Draining	Biologist	R. & E.
	W	Largemouth Bass	?	7	13	Fairlee Pond, Kent Co.	'55	Angling	John Heil	Dillon
	L	Smallmouth Bass	22	5		Deep Creek Lake, Garrett Co.	Aug. 27, '52	Angling	H. E. Doyle, Pa.	Angler
	W	Smallmouth Bass	?	6	5	Prettyboy Reservoir, Balto. Co.	'54	Angling	L. D. Keene	Dillon
	L	Chain Pickerel	27.5	4	4	Upper Magothy River (Fresh? Salt?)	Feb. 25, '51	Angling	?	Angler
	W	Chain Pickerel	?	5	14	Bush River (Fresh? Salt?)	'51	Angling	J.W.Byer, Jr.	Dillon
	L & W	Walleye	28.4	7	6	Conowingo Res., Cecil & Harford Co's.	Oct. 25, '50	Trap Net	Biologist	R. & E.
	L & W	Redfin Pickerel	11.7		7	Deep Creek Lake, Garrett Co.	Sep. 7, '55	Rotenone	Biologist	R. & E.
TROUT	L	Rainbow Trout	25.2	?		Hunting Creek, Frederick Co.	'55	Angling	C. Warrington	Dillon
	L & W	Brook Trout	7.6		2.8	Hunting Creek, Frederick Co.	Aug. '52	Rotenone	Biologist	G. & I.F.
	L	Brown Trout	25.5	6 (est.)		Deep Creek Lake, Garrett Co.	'55	Angling	?	Angler
PANFISH	L & W	Black Crappie	17.0	2	11	Avalon Pond, Baltimore Co.	Nov. 7, '50	Rotenone	Biologist	R. & E.
	L & W	White Crappie	13.4		19.2	Sand's Pond, Cecil Co.	Oct. 15, '56	Draining	Biologist	R. & E.
	L	Bluegill	10.9		16.4	Sand's Pond, Cecil Co.	Oct. 15, '56	Draining	Biologist	R. & E.
	W	Bluegill	10.7		19	Wagner's Lake, Anne Arundel Co.	'54	Angling	Royden Blunt	Angler
	L	Pumpkinseed	9.4		9	Triadelphia Res., Howard & Mont.Co's.	Apr. 28, '51	Trap Net	Biologist	G. & I.F.
	W	Pumpkinseed	9.1		10.7	Smithville Pond, Caroline Co.	Nov. 16, '55	Draining	Biologist	R. & E.
	L & W	Yellowbelly Sunfish	9.5		10.6	Conowingo Res., Cecil & Harford Co's.	Apr. 26, '50	Trap Net	Biologist	R. & E.
	L & W	Rock Bass	10.4		13.1	Deep Creek Lake, Garrett Co.	May 16, '51	Trap Net	Biologist	R. & E.
	L	Warmouth	7.4		4.4	Little Pool, Washington Co.	Oct. 1, '49	Trap Net	Biologist	R. & E.
	W	Warmouth	7.1		4.7	Sand's Pond, Cecil Co.	Oct. 15, '56	Draining	Biologist	R. & E.
	L	Mud Sunfish	8.1		6.7	Chambers Lake, Caroline Co.	Oct. 25, '50	Draining	Biologist	R. & E.
	L & W	Green Sunfish	8.2		14.4	Prettyboy Reservoir, Baltimore Co.	Jun. 1, '50	Angling	?	Angler
	L	Yellow Perch	17	?		Deep Creek Lake, Garrett Co.	Sep. 7, '55	Rotenone	Biologist	R. & E.
	L & W	White Perch	14.3	1	9	Sand's Pond, Cecil Co.	Oct. 15, '56	Draining	Biologist	R. & E.
BOTTOM FISH	L & W	Blue Catfish	32.6	14	5	Potomac River, Frederick Co.	'55	Elec. Shocker	Biologist	G. & I.F.
	L & W	Channel Catfish	28.1	9	14	Potomac River, Frederick Co.	'55	Elec. Shocker	Biologist	G.& I. F.
	L & W	White Catfish	19.0	3	14	Loch Raven, Baltimore Co.	Apr. 22, '52	Trap Net	Biologist	R. & E.
	L & W	Brown Bullhead	18.5	3	1	Sand's Pond, Cecil Co.	Oct. 15, '56	Draining	Biologist	R. & E.
	L & W	Yellow Bullhead	13.5	1	4	Smithville Pond, Caroline Co.	Nov. 17, '55	Draining	Biologist	R.& E.
	L	Carp	38	?		Potomac River, Frederick Co.	?	Angling	C. Hoffer	Warden
	W	Carp	34.8	25 (est.)		Conowingo Res., Cecil & Harford Co's.	May 29, '51	Trap Net	Biologist	R. & E.
	L & W	Goldfish	14.8	4	15	Greenbelt Lake, Prince Georges Co.	Nov. 7, '56	Draining	Biologist	R. & E.
	L & W	White Sucker	23.0	3	9	Sand's Pond, Cecil County	Oct. 16, '56	Draining	Biologist	R. & E.
	L & W	Chub Sucker	16.5	2	14	Smithville Pond, Caroline Co.	Nov. 17, '55	Draining	Biologist	R. & E.
	L & W	Redhorse Sucker	19.3	2	12	Potomac River, Frederick Co.	'55	Elec. Shocker	Biologist	G. & I.F.
	L & W	Quillback (sucker)	20.6	5		Conowingo Res., Cecil & Harford Co's.	Apr. 28, '50	Trap Net	Biologist	R. & E.
	L & W	Hog Sucker	14.6	1	8	Triadelphia Res., Howard & Mont. Co's.	Apr. 5, '50	Trap Net	Biologist	R. & E.
	L & W	Eel	32.9	3	6	Sand's Pond, Cecil Co.	Oct. 15, '56	Draining	Biologist	R. & E.
FORAGE FISH	L & W	Golden Shiner	10.5		9.8	Smithville Pond, Caroline Co.	Nov. 16, '55	Draining	Biologist	R. & E.
	L & W	Fallfish	14.5		13.6	Potomac River, Frederick Co.	'55	Elec. Shocker	Biologist	G. & I.F.
	L & W	Creek Chub	6.2		1.6	Cascade Lake, Washington Co.	Nov. 15, '56	Draining	Biologist	R. & E.
	L & W	Madtom (catfish)	6.8		1.4	Deep Creek Lake, Garrett Co.	Sep. 7, '55	Rotenone	Biologist	R. & E.
	L & W	Mudminnow	3.9		0.4	Smithville Pond, Caroline Co.	Nov. 16, '55	Draining	Biologist	R. & E.
	L	Spottail Shiner (gudgeon)	4.8	?		Chester River, Queen Anne's Co.	Oct. 23, '53	Seine	Biologist	R. & E.

* L for length only; W for weight only; and L & W for length and weight.

** Nomenclature follows American Fisheries Society recommendations.

*** R. & E.: Records collected by Department of Research and Education; G. & I.F.: Records collected by Department of Game and Inland Fish; Dillon: Records from Dillon fishing contest; Angler: Records submitted to author by angler; Warden: Records submitted via game warden.

? Data is missing for this item.

NEW PUBLICATIONS ISSUED

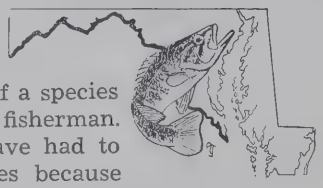
(CONTINUED FROM PAGE 2)

January 1957. pp. 1-25. An interim report of factual information and reasoned judgments for use of the Maryland General Assembly. In view of the widespread interest voiced by tidewater interests throughout Maryland, the following paragraph is a summary of this report.

THE REPORT, PREPARED EXPRESSLY FOR THE INFORMATION OF THE MARYLAND GENERAL ASSEMBLY, REVIEWS PRESENT KNOWLEDGE OF THE SOFT SHELL CLAM, THE INDUSTRY IT SUPPORTS, THE GEAR USED IN ITS EXPLOITATION, AND THE EFFECTS OF THAT GEAR ON TIDEWATER RESOURCES. STATISTICAL RECORDS, DIRECT OBSERVATIONS, AND EXPERIMENTAL RESULTS INDICATE THAT (1) MARYLAND'S SOFT SHELL CLAM RESOURCE IS CAPABLE OF SUPPORTING A MAJOR FISHERY, (2) IF AN ENFORCEABLE LINE CAN BE DRAWN BETWEEN THE SOFT SHELL CLAM FISHERY AND THE PRODUCTIVE OYSTER BOTTOMS, USE OF THE HYDRAULIC CLAM DREDGE DOES NOT CONSTITUTE A BIOLOGICAL HAZARD TO TIDEWATER RESOURCES, AND (3) THE PUBLIC INTEREST AND THE WELFARE OF THE TIDEWATER AREA WOULD BE SERVED BY OBJECTIVE RECONSIDERATION OF USE OF THE RESOURCES OF THE BAY AND ITS TRIBUTARIES, BASED ON EXISTING CONDITIONS.

RECORD MARYLAND FISH SOUGHT

How Big Does That Fish Get?



This is a question frequently asked of the biologist, especially when the fish under consideration is of a species not often taken by the fisherman. Answers to the question have had to be vague in many instances because not enough pertinent data have been available. Records of the largest fish of several fresh-water game species are kept by at least one sportsman's magazine, but many of the species recorded are not found in Maryland, and few pan, bottom or forage fish are recorded.

Biologists' Records Used Freely

About two years ago, this Department began assembling data on the largest fish of each species taken in Maryland waters. Some of these largest-fish were taken by anglers, but the majority were taken by Maryland biologists in the course of their work. Not all the records are of exceptionally large fish and the author has seen several fish which were larger than those listed below, but for one reason or another (usually lack of equipment at the right time and place) the lengths and weights were not recorded. Some of the office records are incomplete—they lack dates, names or other information. Some of the records from anglers are incomplete, also. However, whatever information is listed below is felt to be reliable.

Other Sources Revealed

Source material for these records consist of (1) the files in the Department of Research and Education, (2) files of the Department of Game and Inland Fish, (3) published records from the Dillon fishing contest and (4) direct reports to the author from fishermen, game wardens, etc.

Certain Species May Be Found in Brackish Water

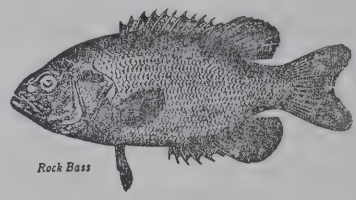
The longest specimen is not always the heaviest. Therefore in the table the longest fish is preceded by "L" (for length), the heaviest by "W" (for weight) and if the specimen is both the longest and heaviest on record it is preceded by "L & W." There is some question whether the chain pickerel listed were taken in brackish or fresh water—they are listed "just in case." No records of pickerel more than about 18 inches could be found that positively were taken in fresh water.

List To Be Corrected and Extended

It is the intention of this Department to collect and publish records of the largest fish for many of the species found in Maryland fresh waters. Fish taken in salt water are not included—at least, not for the present. If interest warrants, a list of the largest specimens of salt-water species (and even game animals such as turkeys or rabbits) may be published at some future time.

New Records Must Be Verified

This is not a contest and the records have no official standing; the Department is interested only in the maximum size for each species regardless of how or by whom they may be taken. The only stipulation is that they be taken from Maryland waters. We would like to hear from anyone who has a fish larger than those listed in the table below. It will be recognized by this Department as a new record if the species, length and weight are verified by a Maryland game warden, fish management man, or biologist. A letter, countersigned by any of these people will be accepted as evidence. Photographs are not necessary but would be appreciated. New lists of record fish will be published as changes warrant.—H. J. ELSER.


Rock Bass

TAGGED YELLOW PERCH SCATTER WIDELY

Results of Interest to Sportsmen

A report on the 1956 yellow perch tagging program was recently presented to several groups interested in the sport fisheries of the Severn and Magothy Rivers. Since most rivers in the State possess populations of fish which are sought avidly by sportsmen, it is believed that there would be considerable widespread interest throughout the State in the results of this study.

Plantings Made In Two Rivers

During February of last year, over 4,300 yellow perch were caught in the Chester River, transported by tank truck to the Annapolis area, and released in the Magothy and Severn Rivers. About half of these fish were tagged and data were collected relating to size, sex and other factors before release. Most of them were between eight and nine inches long. At the end of January, 1957, 12.7% of the tagged fish released in the Severn had been recaptured and 23.6% of those

(CONTINUED ON PAGE 6)

DUCK BANDING RESUMED AT SOLOMONS

(CONTINUED FROM PAGE 1)

heads, six canvasbacks and one ringneck duck have been trapped, banded and released. In three years, therefore, 1,334 ducks have been examined and banded near Solomons by personnel of this Department.

Band Recoveries Provide Interesting Information

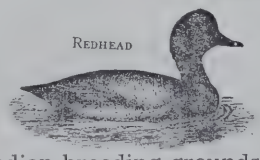
To date 99 bands have been recovered and reported to this office. These include 79 bands returned from lesser scaup, 17 from redheads, two from greater scaup and one from a canvasback. In addition 12 birds banded at Solomons were retrapped in other areas. These birds were, of course, released after the band number was recorded for reporting to the U.S. Fish and Wildlife Service. Of the 12 birds retrapped, 11 were taken at banding stations in Maryland and one was recaptured in North Carolina.

Hunters Recover Great Majority of Bands

Of the 99 bands reported, duck hunters returned 90 from birds that were killed. Other causes of death included four which had been caught accidently in gill nets by fishermen, one which was captured in a muskrat trap, two found dead and two for which the method of capture was undetermined. From this it can be seen that, as expected, waterfowl hunters are the principle means by which bands are recovered.

Migrating Waterfowl Cover Great Distances

Waterfowl banded at Solomons have been recovered from a total of 13 states and two Canadian Provinces. The 79 recoveries from lesser scaup were distributed as follows: Maryland, 37; Virginia, 9; North Carolina, 6; Manitoba, Canada, 6; Ohio, 4; Ontario, Canada, 3 Michigan, 3; Minnesota, 2; Florida, 2; Illinois, 2; Wisconsin, 2; South Dakota, 1; Georgia, 1; and Alabama, 1. The recoveries from 207 redheads banded in 1955 are distributed as follows: Maryland, 7; Minnesota, 4; Ontario, Canada, 2; Wisconsin, 1; and New York, 1 for a total of 17 bands recovered. Since it appears that most of the lesser scaup trapped here breed in the Manitoba area and that some of these same birds travel as far south as Florida to winter, the tremendous distance that at least some of these birds migrate is apparent. Even the distance from Chesapeake Bay to the Canadian breeding grounds (approximately 1,500 miles) which these birds cover twice yearly is impressive.



Waterfowl Information Essential

With an apparently ever-increasing number of hunters afield and with the number of ducks limited by encroachment by man on both the breeding and wintering grounds it can clearly be seen that intensive information is essential to provide the most equitable and efficient use without depleting the resource. Since most of the Atlantic coastal states are cooperating in this banding program it is hoped that sufficient information concerning the various species of waterfowl can be obtained by this method to be of some benefit in instituting wise management practices.—J. R. LONGWELL.

MOURNING DOVE REPORT 1956 HUNTING SEASON

(CONTINUED FROM PAGE 2)

66 per cent juveniles and 34 per cent adults. Birds collected during the 1956 season show a smaller percentage of juveniles than at any time since 1951. In 1951 the season did not begin until October 5 and hence at this time, undoubtedly, more juveniles had attained adult plumage than would have, had the wings been collected September 15 (see Table 2). Similarly, the percentage of juveniles indicated for 1950 and 1949 would have decreased had they been collected September 15 since the season opened on September 1 both these years.

Table 2

Age Composition of Doves Taken First Week Of Season

Season	No. Wings	% Adults	% Juveniles	Date Season Opened
1949	431	24	76	Sept. 1
1950	185	29	71	Sept. 1
1951	145	34	66	Oct. 5
1952	193	30	70	Sept. 15
1953	532	24	76	Sept. 15
1954	810	22	78	Sept. 15
1955	800	25	75	Sept. 15
1956	674	34	66	Sept. 15

Possible Causes of Reduced Juvenile Percentage

Although there have been variations in the relative age composition from year to year, this may not reflect actual changes in the Maryland dove populations. This is due to the possibility that flocks of doves may consist predominantly of certain age groups. Therefore, if only a small number of flocks are sampled these might reflect the age composition of only those flocks rather than the entire population. If sufficient flocks were sampled the results would be more meaningful. In the latter case the decline in percentage of juveniles could be attributed to one or several of the following reasons.

1. An earlier peak of hatching which would result in more juveniles having attained adult plumage by September 15.
2. Increased mortality of later hatches which would lower the percentage of juvenile doves taken September 15.
3. Increased mortality of all juveniles.
4. Decreased reproductive success or number of reproductive attempts.
5. Possible early migration of juveniles separately from adults.
6. A sample of wings not sufficiently large to accurately denote a change of this magnitude.

Attempts have been made for the past eight years to gather enough data to be able to make intelligent estimates as to which of the above reasons might account for any changes in the dove population. Dove hunters and game wardens have been very cooperative, but nevertheless it has not been possible to obtain enough data to detect such population changes.

Hatching Dates Determined from Age of Juvenile Wings

Examination of the hatching dates, determined by

(CONTINUED ON PAGE 6)

SHELLFISH STUDIES CONDUCTED BY LAB.

(CONTINUED FROM PAGE 1)

of hydraulic clam dredging has just been published. This supplies information of use to the General Assembly in their consideration of regulatory measures for the industry.

Oyster Setting and Seed Growth Important In Chesapeake Projects

Active projects in the Chesapeake oyster research program center around setting and oyster growth. The time and intensity of setting are determined annually by test shell exposures in the Solomons area and in selected areas that offer potentialities for seed production. Counts of the surviving commercial set on State shell plantings and upon old cultch on natural bars, together with observations on the composition of the bar populations, are made during the fall and winter months in cooperation with the Department of Tidewater Fisheries and the Annapolis Shellfisheries Laboratory of the U.S. Fish and Wildlife Service. Comparisons of rates of growth and of mortality are made among groups of experimental seed oysters from different sources when planted on trays at Solomons and in Chincoteague Bay. Determinations of oyster larvae abundance are made by means of single continuous samples of water pumped from a 12 foot depth by a boat moving the length of the area to be studied. The relationship of the observed number of larvae to the subsequent spat-fall on test shells is being studied as a possible means of predicting oyster sets in a given area. Trays of shells are planted during different months of the year at a selected location in St. Marys River in order to compare the efficiency as cultch of shells planted at different seasons. The weighted incidence of infection by the fungus **Dermocystidium marinum** (a standard method for scoring the degree of infection) is determined each fall from oyster samples in those areas where the parasite has been found.

Screw Borers or Drills the Chief Chincoteague Problem

Studies of the seasonal abundance of oyster drills in Chincoteague Bay, and of the effectiveness of drill traps as a control measure are being made in cooperation with the U.S. Fish and Wildlife Service. Oyster sets on experimental plantings of shells in intertidal windrows, and in suspended wire bags, are being evaluated as a possible source of local seed. The growth and survival of this seed is being compared with that from other sources. Data upon the nature and relationship of the hydrography of the area to oyster growth and to the distribution and abundance of the hard clam are being gathered, together with a general survey of the marine biota.

Special Workers In Summer

During the summer season advanced undergraduate and graduate students from various schools serve as laboratory assistants in most of the projects named. More intensive observations at that time are thus made possible and special short term projects are sometimes undertaken by the students or by experienced visiting investigators. Compilation of hydrographic and meteorological data is on a continuous basis so that the effects of seasonal and annual variations in environment upon shellfish can be evaluated.—G. F. BEAVEN.

MOURNING DOVE REPORT 1956 HUNTING SEASON

(CONTINUED FROM PAGE 5)

ages of juvenile wings, shows that a peak of hatching occurs around the last week of May and the first week of June. After this, hatching declines rapidly but shows a tendency to again peak (at a much lower percentage level than the first peak) about the middle of July. Following this period, hatching drops off until, by the middle of September, very few doves are being hatched. The latest hatching date recorded during 1956 was October 9. However, only scattered nestings and hatchings are evident after September 15. It should be taken into account here that an unknown number of early hatched juvenile birds have completed their molt at the time of the survey and are not identifiable as juveniles; consequently, hatching dates for these are not included. Similarly, a number of nestling doves have not left the nest by opening day and these are not available to the hunter at this time. However, this latter group becomes available later in the season and their hatching dates can be determined.—J. R. LONGWELL.

TAGGED YELLOW PERCH SCATTER WIDELY

(CONTINUED FROM PAGE 3)

released in the Magothy River had been caught. In the Severn River, 40% of the recaptures were taken inside the river. Most of the remaining recaptures came from commercial netters outside the river. The Magothy, on the other hand, produced only 12% of the recaptured fish tagged there. Most of the remainder (88%) were taken by netters outside the area.

Most Tagged Fish Left Rivers

Returns from areas outside the two river systems indicate wide scattering to other parts of the Bay. Most fish were returned from Baltimore and Kent Counties but some were caught from such remote localities (from the release point) as Bush River and Taylor's Island. The general patterns indicate that a large portion of the stocked fish started out of the rivers very quickly and spread throughout the central part of Chesapeake Bay. Yellow perch in the Severn were released somewhat farther upstream than were those in the Magothy. This may explain the discrepancy in returns from within the two rivers.

Yield From Stocking Estimated

One of the objectives of this study was to arrive at some estimate of the yield to fishermen that might be expected by "put and take" planting of adult yellow perch. It is interesting to note that local fishermen caught less than 5% of the tagged fish within the two rivers. The economic feasibility of this return can be judged only by those who are paying for the stocking program. Information on the movements of stocked yellow perch populations and on the size and sex compositions of the catch in the Chester River may add to the general knowledge of the species and an understanding of the importance these factors play in planning future management programs.—R. MANSUETI and G. J. MURPHY.

MARYLAND TIDEWATER NEWS

Entered as Second Class Matter at Solomons, Maryland. Office at Chesapeake Biological Laboratory, Solomons, to which all communications should be addressed.
EDITORIAL STAFF: D. G. CARGO, H. J. ELSER, G. F. BEAVEN, & J. R. LONGWELL.

Volume 13 MARCH—APRIL, 1957 No. 6

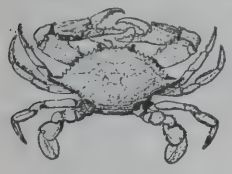
BLUE CRAB RESEACH PLANNED

$175,000 For Crab Research

The Commissioner of Fisheries, Department of the Interior, Hon. Arnie J. Suomela, has announced that $175,000 will be spent for blue crab research during the next two years. These monies, allocated under the Saltonstall-Kennedy Act, are derived from tariffs on imported fishery products and have just been increased by recent legislation in Congress. At the request of the Atlantic States Marine Fisheries Commission, the U.S. Fish and Wildlife Service has prepared the following research programs to be supported by these funds.

Technological Studies Stressed

Primary emphasis is to be placed upon a proposed study of the cooking, handling, and distribution problems of the blue crab fishery, for which $100,000 is to be allocated. The purpose of this project is to determine which practices now being used are most satisfactory, how improvements of present practices can be accomplished, and then to promote the adoption of the best methods among blue crab processors. It is anticipated that successful completion of the project will improve the product, stabilize the industry economically, and conserve the natural resource on which the industry is based by increasing the yield of crab meat per crab.



Seafood Laboratory Selected

Since the University of Maryland Seafood Processing Laboratory at Crisfield, Maryland, has both the staff, equipment, and experience to handle this type of study, plans are underway to center this operation at that institution. Under the supervision of Drs. R. A. Littleford and Melvin Benarde, the approach to the problem will be from two directions. For immediate remedial effects, an active, in-plant assistance program utilizing known good processing and sanitation procedures will be made in the several principal blue crab producing areas. As the research work on the development of more economical procedures and a better product proceeds, pertinent findings will be made available to the industry through field demonstrations, visual educational aids, and published reports.

Biological Research Outlined

The remaining $75,000 is to be expended for biological investigations, leading to information on such

(CONTINUED ON PAGE 4)

NEW RECORD FOR RED SQUIRREL IN MARYLAND

Late in January, Mr. Joe Hopwood of Annapolis notified this Department that he had seen some unusual looking squirrels in the yard of a house next to the Naval Academy. A trap was set and on February 21st an adult male red squirrel **(Tamiasciurus hudsonicus)** was captured. On February 23rd an adult female red squirrel was captured. Mr. Hopwood says that the neighbors in the immediate vicinity of the house have been aware of the existence of a colony of these squirrels for several years. This is a very interesting record because the nearest records of red squirrels, of which the author is aware, are on the northern and western outskirts of Baltimore. The author would appreciate receiving any records of red squirrels found east of Frederick, Maryland.—V. F. FLYGER.

OYSTER BEDS AND WATER DEPTHS

Different Regions Vary in Typical Depth of Beds

Often the question is asked: How deep is the water where oysters grow? The answer is somewhat dependent upon the particular body of water in which the oysters are found. In northern waters such as Long Island Sound, most oysters are taken from fairly deep beds. Along the South Atlantic and parts of the Gulf Coast most oysters are taken from intertidal areas, that is, along the shores between the normal high and low water marks. Also, on our Pacific Coast, most of the oysters are grown intertidally. Here in the Chesapeake our major producing areas are in comparatively shallow water ranging from about six to thirty feet in depth. However, the Chesapeake has very diverse conditions so that in some places we may find oysters growing intertidally while in others they grow at comparatively great depths.

Wave Action Limits Growth in Shallow Areas

As most people know, oysters grow attached to shells, other oysters, stones or suitable solid objects that prevent them from sinking into the bottom. An oyster starts life at less than fly speck size and cannot support itself upon a mud or sand bottom where it would soon become covered over and smother. Along the shores of the Bay itself, and of its larger tributaries, waves pound the beaches and typically churn up the bottom out to depths of six feet or more. This action tends to sort out the bottom material and form sandy

(CONTINUED ON PAGE 3)

OYSTER DISPLAY TEACHING KIT PRODUCED FOR SCHOOL USE

Over 150 Displays Are In Schools

The Department of Research and Education has prepared a kit of materials to help teachers present the Maryland oyster story in their classrooms. This teaching aid is sold at the cost of the material used in making up the kit.

Life History Is Illustrated By Five Specimens

1. Week-old Spat. Oyster larvae swim around for about two weeks, then they attach or "set" on an object such as an oyster shell and change to resemble the adult oysters in shape, but are very tiny at first.
2. Month-old Spat. These older spat can be seen readily but have a very thin shell.
3. Year-old or "Seed" Oysters. This is the usual age at which shells and the attached young oysters are taken up with tongs or dredges and transplanted to a new location. For that reason, oysters at this stage are often called "seed" oysters.
4. Market Oyster. For this specimen the oyster meat is removed and the shells are glued together. Oysters are always, or nearly always, attached by the left shell to an object such as an oyster shell. The right or upper shell is usually flatter than the lower or left shell.
5. The Right and Left Shells of a Market Oyster. These two parts show how neatly the shells of an oyster fit. The portion of the hinge can be seen readily. In the living oyster there is a hinge ligament which keeps the shells open while the oyster feeds. The shells are closed by a strong muscle whose location is shown by the dark scars on the two shells.

Oyster Enemies Are Shown By Six Samples

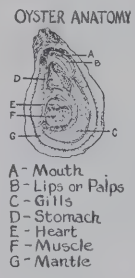
1. Oyster Drills. There are two kinds of oyster drills or "screw borers" in Maryland waters. These snails have a rasp-like structure on the tongue which is used to make a hole through the oyster's shell. When the shell is penetrated, the snail proceeds to eat the oyster meat. Oyster drills are pests in the saltier waters of the Chesapeake Bay but they are rarely troublesome north of Tangier Sound. The loss caused by drills is the chief problem of the oyster growers of Chincoteague Bay.

OYSTER DRILL

2. Hooked Mussel. These mussels frequently attach themselves to oysters in great numbers. They anchor themselves to oyster shells by tough elastic threads. Where mussels are abundant they interfere with the feeding of older oysters and they cover shells which oyster spat might otherwise occupy.
3. Serpulid Worms. The twisted tubes constructed by these worms are shown on a shell. They take up space which might otherwise be used by oysters in setting. At times these tubes form masses one half inch or more in thickness which may smother spat and interfere with oyster growth. The serpulid worm is a serious pest in the Chincoteague Bay area.
4. Boring Sponge. The boring sponge makes canals or channels in an oyster shell. The sponge does not consume the oyster meat but can eventually cause the shell to break up.
5. Barnacles. Barnacles, because of their attaching habits, occupy space which might otherwise be occupied by young oysters.
6. Bryozoa. Bryozoa can grow rapidly and their lace-like growth may quickly cover empty oyster shells or the shells of living oysters. When this occurs, there is no suitable space upon which young oysters can set.

Anatomy Is Shown By Picture

A plastic laminated picture shows the larger organs or parts which make up the body of an oyster.



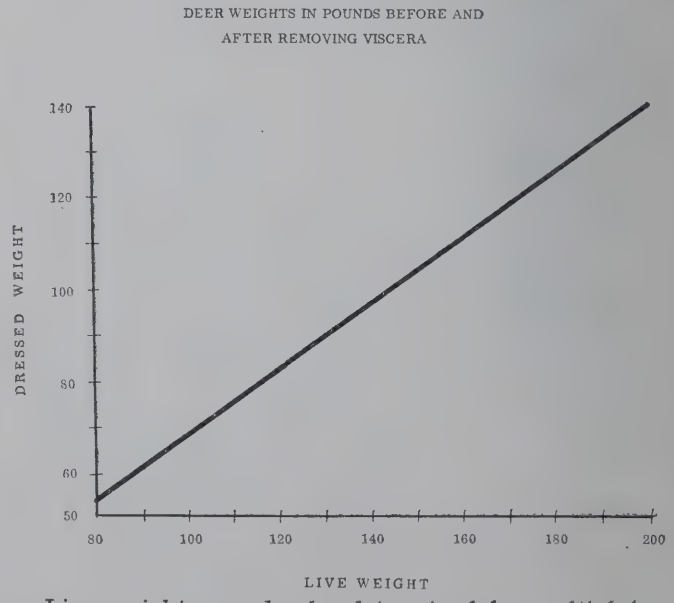
Display Is Sold Only To Md. Schools

Due to the amount of labor required to collect and prepare the specimens, sales are limited to schools of the State. Persons interested in this display kit and other teaching materials should write to the Board of Natural Resources, 100 College Avenue, Annapolis, Maryland, for a catalog.—B. L. ASHBAUGH.

LIVE WEIGHT—DRESSED WEIGHT OF DEER REVEALED

Aberdeen Deer Checked

Hunters bringing dressed or gutted deer into a checking station frequently ask what the live weight of the animal could have been. Other hunters bring in entire animals and ask what the animal will weigh after the entrails are removed. Data that will answer these questions were gathered during the 1956 deer season at Aberdeen Proving Ground. Fifty-seven deer were weighed before and after the heart, lung, stomach, intestines, kidneys, liver and reproductive organs were removed. The graph shows the relationship between the weights. Using the graph the hunter can determine the live weight of a dressed deer or vice versa.



Live weight can also be determined by multiplying dressed weight by 1.44 and dressed weight may be determined by dividing live weight by 1.44.—V. F. FLYGER.

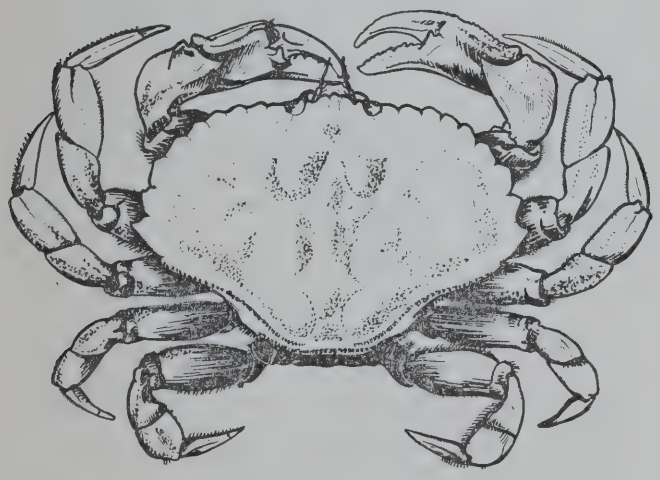
ROCK CRABS INVADE CHINCOTEAGUE BAY

Large Numbers Caught

Large numbers of rock crabs, **Cancer irroratus,** have been caught in Chincoteague Bay in recent weeks. The local watermen report the capture of up to three bushels per day of this species in their crab pots in Sinepuxent, Newport and upper Chincoteague Bays. This situation is unique this year for heretofore only an occasional specimen has been caught. They are of fair size, averaging four to six inches wide and they possess legs which contain a considerable amount of meat.

Commercially Important in New England

This crab is closely related to the edible crab of the Pacific Coast. It is utilized commercially in the New England area, particularly around Boston, but has not been of commercial importance in Maryland. During the period from 1943-1953, the annual catch varied from two to nine million pounds in Massachusetts. The meat yield of these crabs is about the same as that of our blue crab. The crabs are caught in wooden traps and the fishery restricts itself to male crabs above 3¾



Rock Crab

inches in width. Small males and all females are protected. Their growth is slow and present knowledge indicates that they moult only once a year, probably in March or April.

Rock Crabs A Northern Form

These crabs have apparently moved into the Bay area from the Atlantic Ocean through the Ocean City inlet. It is felt that, since they are common in colder waters, as the water temperature rises, they will return to the ocean. Periodic invasions of the Chincoteague area by animals not normally found there occur quite frequently. Other northern forms such as the lobster, starfish, and certain species of fish are occasionally found in the area, far removed from the areas where they usually occur. Also, during the summer months, unusual visitors from sub-tropical areas often move into Maryland waters from the nearby Gulf Stream.—F.W. SIELING.

OYSTER BEDS AND WATER DEPTHS

(CONTINUED FROM PAGE 1)

beaches. While the sand may feel firm to walk upon it is constantly shifted with changing winds and currents so that oysters or shells may be alternately buried or uncovered. Upon such sandy beaches and adjacent sand bars oysters cannot long survive. For this reason oysters seldom are found along wave swept shores in water less than six to twelve feet in depth. The recent hurricanes on some exposed shores destroyed many oysters along the inner portion of the beds in waters considerably deeper than are normally disturbed by waves.

Intertidal Oysters Occur In Narrow Waterways

Though somewhat unusual, oysters in the Chesapeake occasionally are found growing between the tides. These occur mostly in narrow waterways where large waves do not develop, and where there are stony or shelly shores that offer points of attachment for the tiny oysters or "spat." They also sometimes attach between the tides to pilings or sea walls. Oysters can withstand severe freezing for brief periods so long as they are not jarred or handled while frozen. However, in severe winters it is possible that drift ice may form and bump the frozen, intertidal oysters so that many are killed. Also there is still another hazard that makes their survival difficult in the Chesapeake area. The normal rise and fall of the tide in much of the Bay is less than two feet, but strong and persistent winds may blow the water out to several feet below its usual level, and so leave the intertidal areas completely bare for days at a time. Under such conditions too much drying out, especially on sunny south facing shores, may injure the oysters. For these reasons few intertidal oysters mature in the Chesapeake area except in narrow channels less subjected to the above conditions. They are fairly common at some points along coastal waterways near the ocean where tidal conditions are more stable.

Lack of Oxygen May Kill Oysters in Deep Water

One of the factors essential to oyster life is a sufficient supply of dissolved oxygen in the water where the oysters live. Oysters do not need as much oxygen as do the more active marine animals such as fish or crabs. In fact, especially when the water is cold, they may survive for a good many days without oxygen. However, in warm water under summer conditions, they cannot live for a very long period without at least a small supply of oxygen in the water. Unfortunately for the oyster, there are many places in the Chesapeake area where the amount of oxygen in deep water may drop to zero for long periods during hot weather, and under such conditions oysters cannot remain alive. Where the bottom sediments contain large amounts of organic matter, even brief periods of zero oxygen may permit certain bacteria to break down organic compounds and release hydrogen sulphide, a gas that smells like rotten eggs and is toxic or poisonous to animal life. Sometimes this happens following unusual weather conditions and oysters that have become established during preceding years may all be killed quite quickly during even brief periods of zero oxygen. Lack of oxygen also may kill fish or crabs but these animals usually are able to move away into more favorable water. It is not uncommon, though, for

(CONTINUED ON PAGE 4)

OYSTER BEDS AND WATER DEPTHS

(CONTINUED FROM PAGE 3)

crabs trapped in pots set in deep water to die under these conditions during hot weather, since the traps prevent them from swimming up into more shallow water where the oxygen supply is sufficient.

Low Oxygen Normal in Deep Water During Summer

Oxygen dissolved in the water comes chiefly from the air at the water's surface. Wave movements and currents carry oxygen laden water down to considerable depths at most seasons. In summer, however, certain conditions in the Bay result in a total lack of oxygen in extensive areas of deep water. The causes are rather complex. As the upper layers of water are more strongly heated they become lighter than the colder bottom water and so resist sinking. The movement downstream of fresher water near the surface is accompanied by an upstream movement of saltier water near the bottom. The salt content makes this bottom water heavier than the fresher surface water and this is an additional factor in preventing the mixing of top and bottom layers. Without renewed supplies of oxygen from the air the amount present is soon reduced by animal respiration and by chemical combinations with various substances. At higher temperatures the ability of water to hold oxygen in solution is reduced while respiration and chemical demands are stepped up. The net result is the building up of huge pockets of relatively stagnant water in the deeper areas that may remain depleted of oxygen for many weeks in summer. When the surface water cools in the fall it eventually becomes heavier and sinks so that oxygen is carried down into the deepest holes and the water remains easily mixed by storms until summer conditions again occur. Thus marine animals can live in the deepest water of the Bay during fall and winter, and may seek out these deeps as a favorable place to congregate.

Critical Depth May Vary

Each summer is different in the extent to which the lack of oxygen occurs. The condition is more widespread about half way up the Bay, where oxygen in most places becomes zero at depths of fifty feet or more. Sometimes, however, after very hot and calm weather, the oxygen depleted water may extend up to within thirty feet or less of the surface. Steady winds from one direction across the Bay can push the surface water towards one shore and cause a return flow near the bottom that may bring oxygen depleted water farther in towards the opposite side. Near the mouth of the Bay and at its head, the areas of stagnant bottom water seldom form since the water is not as deep as in the central portions, and mixing is better. Where swift currents swirl around points or through narrow channels of deep water, the surface water may be carried to the bottom, and abundant oxygen then is found at great depths even under summer conditions.

Deepest Oyster Bed Found in Patuxent

During the Yates Survey (1906-1912) it was found that most oyster bars in Maryland occur in water between three and thirty five feet deep. However, the Patuxent River was found to have the outer limits of some bars extending into depths of fifty to sixty feet and the deepest known recorded depth for Chesapeake oyster growth is found at Point Patience, near Solomons. From this location, Dr. Graves reports that oysters were caught in good condition from a depth of one hundred and thirty feet. At Point Patience the Patuxent River narrows to a fraction of its average width and makes an abrupt turn. Here the current flows very swiftly, with great swirls and much turbulence that mixes the water from top to bottom. The deep channel is kept scoured out and there are reports of patent tongers catching oysters at depths even in excess of that quoted by Dr. Graves. Such conditions are exceptional, and there are only a few other known bars in the Chesapeake area where oysters grow at fifty or more feet. Over most deep bottoms the lack of oxygen in summer prevents oyster survival so that there seems little likelihood that many undiscovered extensive deep water beds of oysters can exist in Maryland or Virginia.—G. F. BEAVEN.

BLUE CRAB RESEARCH PLANNED

(CONTINUED FROM PAGE 1)

subjects as the causes of fluctuations in abundance and their prediction, definition of the major stocks of crabs available to the fishery, and causes of yearly fluctuations in the distribution of local stocks of crabs. Although no definite arrangements have been made for the administration of this work, a broad research program, developed by the Blue Crab Committee of the Atlantic States Marine Fisheries Commission (see **Tidewater News,** January 1956), is being proposed. The initial stages of this work will investigate the relationships of various environmental factors with the pre-commercial sizes, including the eggs, larvae, and early and late stage juvenile crabs. The headquarters for these biological studies will be located at the Service's laboratory at Beaufort, North Carolina.

Laboratory at Solomons to Cooperate

Members of the crab industry sincerely feel that these programs are necessary to the continued economic success of the crab fishery as a marine resource on the East and Gulf Coasts. It is expected that the results of these investigations will alleviate some of the marketing and production problems which have beset the industry in the past. The Chesapeake Biological Laboratory will continue to work toward a furthering of the objectives outlined by the Crab Committee through the continuance of its own research programs dealing with the species and through the closest cooperation with the agencies responsible for this new research program.—D. G. CARGO.

MARYLAND TIDEWATER NEWS

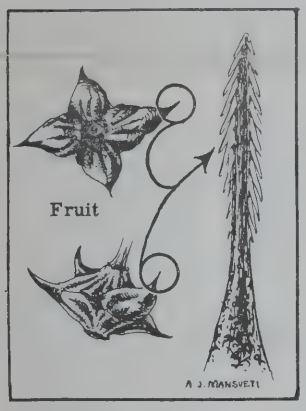
Entered as Second Class Matter at Solomons, Maryland. Office at Chesapeake Biological Laboratory, Solomons, to which all communications should be addressed.

EDITORIAL STAFF: D. G. CARGO, H. J. ELSER, G. F. BEAVEN, & J. R. LONGWELL.

Volume 13 MAY—JUNE, 1957 No. 7

FIGHT AGAINST WATER CHESTNUT RENEWED

Danger Continues In Gunpowder Area



Magnified View of One of the Barbed Spines of the Water Chestnut and the Seed.

The infestation of the Gunpowder River area by water chestnut remains serious. Hundreds of plants of this annual pest have come up again this season. Since new crops appear each year from seed it is necessary that every plant be destroyed before it can produce seed. Most seed germinate the following spring but some may remain dormant for several years so that destruction of the plants must continue each season until no more appear. As long as seed production continues the present beds will expand and new ones appear. There is the constant threat that some of the seed may be introduced on the Susquehanna Flats where vast acreages could be covered, with resulting additional destruction of waterfowl and fish habitats, stoppage of navigation, and ruining of bathing beaches by the sharp spiny seed coverings.

Control Measures Underway

Initial control measures were undertaken in 1955 by

(CONTINUED ON PAGE 4)

EXHIBIT ROOM FEATURED AT LABORATORY

Displays Open To Public

The Exhibit Room at the Chesapeake Biological Laboratory will be open to the public throughout the summer. A receptionist-guide will welcome visitors from 9:00 A.M. to 5:00 P.M. daily, Monday through Friday. Persons who come may select free material from the display of fact sheets on various natural resources, and of back issues of the **Maryland Tidewater News** which are available.

Bay Resources Featured

Since the principal work of the Chesapeake Biological Laboratory is concerned with the Bay, the various estuarine resources are given prominence in these displays. Labeled specimens in cases show the complete life history of the oyster and its enemies. One case presents the life history of the blue crab and

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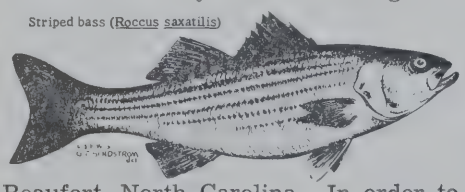
STRIPED BASS TAGGING STUDY IS UNDERWAY

Tagged "Rock" Worth Thousands of Dollars To Bay Fishermen

Striped bass or "rock" are literally and figuratively the "money fish" of Chesapeake Bay. Biologists from the Laboratory at Solomons, as part of a scientific study during Spring, 1957, have bought from fishermen, tagged, and returned alive over 850 striped bass to the rivers in which they were caught. These are divided among the Potomac River, the upper Chesapeake Bay area, Elk River, and a few in the Choptank River. Biologists from the Maryland Tidewater Fisheries Department have also tagged hundreds of striped bass in the Bay this year as part of this study, bringing the number tagged to well over a thousand in Maryland waters. Virginia biologists aided by Federal scientists similarly have tagged over a thousand striped bass in their waters of Chesapeake Bay. All of these combined are worth at least $3,000 in rewards to lucky fishermen. To add to the bonanza of the Bay, another "Diamond Jim," marked with a diamond-studded jaw ring tag and worth $25,000 was released as an advertising stunt near Annapolis, Maryland, on June 7, 1957. With "Diamond Jim," other striped bass with tags worth up to $500 have also been released.

Reward For Tags From Recaptured Fish

Fishermen who catch some of the 3,000 striped bass tagged by scientists will receive a reward of $1.00 for the return of each numbered tag removed from a recaptured fish. These tags, usually bright red, and attached to pins, rings, or nylon threads on the fish's body, carry the address of the U.S. Fish and Wildlife Service. Thus, anyone recovering tags should send them immediately to the address given on the tag—U.S. Fish and Wildlife Service, Washington, D. C., or to the U.S. Fishery Laboratory, Beaufort, North Carolina. In order to receive the reward, the collector must state in detail where, when and how he caught his fish. A sample of scales from the tag attachment site is desirable. The fishermen receiving the reward will be informed by the U.S. Fish and Wildlife Service where and when the fish was originally tagged. The Service is cooperating with Maryland, Virginia, and several other states along the



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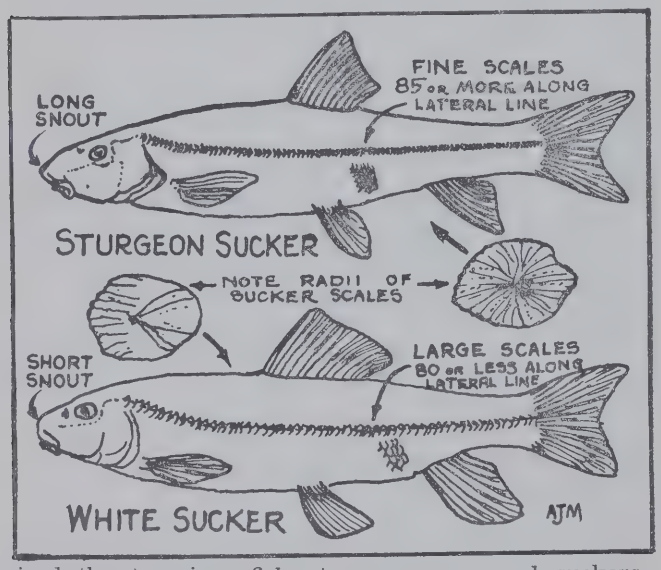
RARE LONGNOSE OR STURGEON FOUND IN MARYLAND

New Record From Whitehorn Lake, Garrett County

The longnose sucker, known scientifically as **Catostomus catostomus catostomus** (Forster), was discovered for the first time in Maryland waters, September 25, 1956. This finding is a local event of great zoogeographical and ecological interest. Most important, it revives the possibility that some of the rare fishes that were believed exterminated by acid mine wastes in the Ohio watershed of Maryland may still be found living in certain western Maryland mountain streams. During routine draining of Whitethorn Lake, Garrett County, by representatives of the Maryland Game and Inland Fish Commission and the Maryland Department of Research and Education, about 10 of these fish were collected by Harold Elser, fishery biologist of this Department. They were not immediately recognized during the hustle and bustle of field operations—in fact, at the time, the fish superficially resembled oversized longnose dace, an interesting minnow found in the Maryland upland waters. At the Chesapeake Biological Laboratory the writer recog-



nized these curious fish at once as unusual suckers. Distinct differences in details in the scales and the elongated snout in the specimens positively identified them as the unique and rare longnose suckers.

Maryland Record Second Southernmost

The discovery of this new species in Maryland was not wholly unexpected. The longnose sucker is distributed in colder lakes and streams from Alaska and northern Canada south to the northern Rocky Mountains, the Great Lakes Basin, and northeastern New England. In 1878 David Starr Jordan was the first and last to record it from the Pennsylvania section of the Youghiogheny River near Coulter, at McKeesport, which is approximately 50 miles downstream from, or north of, the Maryland line. It has never been found in Pennsylvania since. In 1900, Goldsborough and Clark recorded this species for the first and last time in the Monongahela River system in West Virginia, about 55 miles southwest of the Maryland locality. Like the Pennsylvania record, it has not since been found in West Virginia waters. The latter is the southernmost record, while the Maryland record is the second southernmost locality for this species anywhere in North America. Since part of the Youghiogheny River occurs in extreme western Maryland, this species was assumed to occur there. However, no prior records of this species had been obtained so that it was omitted from checklists and keys on the assumption that acid mine wastes may have eliminated it from Maryland streams. Whitehorn Lake drains into Herrington Creek, which flows east about two miles to the Youghiogheny River. This river flows north into Pennsylvania to McKeesport where it joins the Monongahela River on its way to the Ohio River. Many ichthyologists believed that most of the unique fish fauna of the Youghiogheny River mountain watershed had been lost for all time. The discovery of the longnose sucker raises the hope that some of the unique fish that are believed extinct may once again be found. Many of the game fish now found in Maryland part of the watershed have been introduced.

Longnose Suckers In Maryland Are A Relic Population

Fishes living in the mountain streams of the Allegheny Plateau are highly restricted by physiographic barriers such as swift cataracts and impassable falls. When the last ice sheet covered northern Pennsylvania, the floods of cold water killed or forced many of the existing fishes of Maryland southward. These waters, derived from the melting of the receding glaciers, formed a network of waterways that connected many currently unconnected watersheds, and, consequently, fish had access above waterfalls and other such barriers. These waters also allowed such cold water forms as the trouts, sculpins and longnose suckers to enter the labyrinth of cold water streams of western Maryland from the southern unglaciated areas. Thus, it seems likely that the longnose sucker was dispersed into and landlocked in the upper Youghiogheny River during early postglacial times before these areas became isolated. As weather conditions moderated, it may be possible that most of the longnose sucker populations in southern climes below the glaciated areas died out, with the possible exception of the Maryland stock and those from Pennsylvania and West Virginia. Thus, it seems likely that the Garrett County population is a relic group that has persisted since the last glacial epoch. Like the old established families of Maryland that trace their settlement back 300 years, so the longnose suckers can trace their lineage in Maryland waters back 15,000 to 20,000 years!—R. J. MANSUETI.

FISHERIES BIOLOGISTS JOIN LABORATORY STAFF

The Department of Research and Education takes pleasure in announcing the appointment of two new staff members who will work on the fisheries problems of the Chesapeake Bay.

Dr. Robert J. Muncy brings an unusual background to fishery research. He was trained in forestry and wildlife conservation at the Virginia Polytechnic Institute, spent two years of active duty with the U.S. Army, obtained his Master's Degree in Wildlife Management at Virginia Polytechnic Institute, and then took advanced graduate training in fishery biology at Iowa State College, Ames, Iowa, under Dr. Kenneth Carlander. He minored in Botany and Statistics. Dr. Muncy completed his Doctor's Degree in February 1957, and moved to Solomons with his wife and two-year old daughter in April.

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FISHERIES BIOLOGISTS JOIN LAB. STAFF

(CONTINUED FROM PAGE 2)

Dr. Frank J. Schwartz came to the Department from West Virginia University where he had been teaching Ichthyology, Limnology, Systematics, Statistics and Fisheries Biology. Dr. Schwartz took his Master's and Doctor's Degrees at the University of Pittsburgh and has had broad experience in fisheries problems. Most of his work has been on fresh water fish, but he and his students have already collected and studied some of the Bay species.

Both of these men will work on the problems under the general direction of Dr. Romeo Mansueti, who is in charge of research on Bay fish at the Chesapeake Biological Laboratory.

The Department cordially welcomes these scientists and looks forward to having them contribute by learning more about Bay fish and solving some of the important fisheries problems.—L. E. CRONIN.

GOOD WINTER SURVIVAL AND SPRING SET OF SOFT SHELL CLAMS

Abundant Future Crop Indicated

Spring sampling of various soft shell clam producing areas throughout the State has revealed a very good winter survival of last autumn's set. These clams, most of which set about the middle of October 1956, now average more than one half inch in length and will reach their market size of two inches during spring and summer of 1958. The soft shell clams of the Chesapeake Bay grow to this minimum size limit two to three times as rapidly as do those of the same species in New England.

Hazardous Clam Life Must Be Considered

The mere presence and abundance today of this particular age group, however, is not a positive indication of their availability to the digger in 1958, even though they have now survived what is probably the most crucial period of their life. The effects of such natural phenomena as heavy storms are decisive in determining their future as with many other resources of the Bay. Those factors which cause a shifting of the bottom materials are probably indirectly responsible for the greatest mortality among the clams which reach this stage in their life history. In addition, there are many known and unknown natural enemies which can be expected to take a heavy toll.

Spring Set Revealed

A reason for optimism is the apparently successful spring set now taking place. This set was first observed beginning the second week of May. In the past, spring spawning was known to occur, but very little successful setting was observed. The annual set of the past few years thus appeared to be largely a result of the autumn spawning . This year the Laboratory is making detailed studies designed to reveal the fate of this early spring set and the extent to which it contributes to future crops as compared with the autumn set of the previous year.

Studies Now In Progress

Weekly samples of bottom material are being examined and all bivalve mollusks extracted, identified, and measured. The microscopic free-swimming larvae of the soft shell clam are collected by means of an extremely fine mesh net. These investigations are part of a two-year study being conducted by the Chesapeake Biological Laboratory at Solomons to determine, more specifically, the extent of the reproductive period, the intensity of the set, and the early growth and survival of the sets of our native clams.—H. T. PFITZENMEYER.

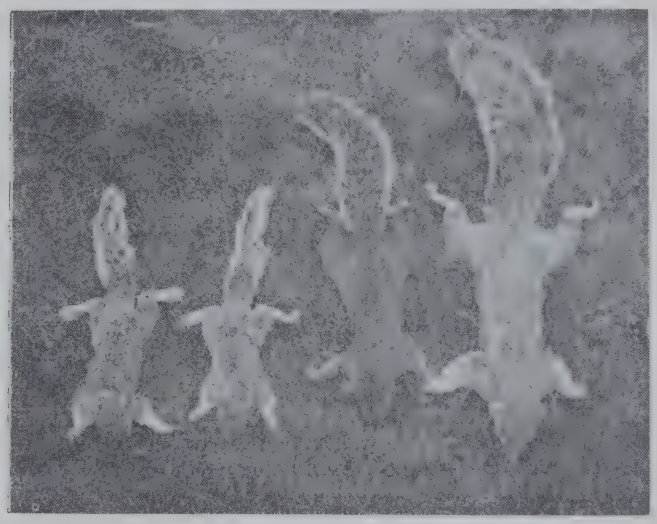
FOX SQUIRREL STUDY INITIATED

A Rare Mammal

One of the rarest of our North American mammals is the Bryant or Gray Fox Squirrel **Sciurus niger neglectus (Gray)** which is found in only six counties of the Eastern Shore of Maryland. This large squirrel was much more widespread in the preceding century, specimens having been recorded from Wilmington, Delaware, and the vicinity of Reading and Philadelphia, Pennsylvania. Fox squirrels are now restricted to a few scattered tracts of mature, mixed hardwood-pine forest in Kent, Queen Annes, Talbot, Dorchester, Wicomico and Somerset Counties. The decrease in range and apparent numbers of this animal has probably been due to lumbering operations and not to hunting. The advent of the chain saw and chemical control of hardwoods may eventually exterminate this animal.

Differs From Western Fox Squirrel

Little is known about the gray fox squirrel. Apparently, it differs considerably in habitat requirements



from the Western Fox Squirrel **Sciurus niger rufiventer Geoffroy).** The western subspecies was unknown in Michigan until logging operations had broken the woodlands into small tracts. The gray squirrel which had been common became less numerous and the fox squirrel spread through lower Michigan and now comprises 95 percent of the squirrels shot in that state. Just the opposite has occurred in Maryland and nearby areas where removal of the original forest appears to have been a major factor in the near elimination of our subspecies of fox squirrel.

Science May Save Our Rare Fox Squirrel

A research project is being initiated by this Department to study the life history and habitat requirements of the fox squirrel. By increasing our knowledge of the fox squirrel we may be able to do something to save this interesting animal. In the meantime the best method for preserving the fox squirrel is to set aside tracts of large trees. Restrictions of hunting would probably have little effect in conserving this resource.—V. F. FLYGER.

EXHIBIT ROOM FEATURED AT LABORATORY

(CONTINUED FROM PAGE 1)

another depicts the various kinds of crabs found in Maryland. Other displays feature the State's important fish, their feeding habits and how they are caught. A panel is used to explain a duck-banding project and the results obtained from this study.

Important Resource Facts Illustrated

Large wall charts show important facts that have been compiled by the Department on oyster, crab and fish production; the number of licensed watermen and hunters; the annual deer harvest; and the freshwater ponds that have been drained. A special wall panel summarizes a ten-year study made on the oyster spat survival on natural cultch.

Electrical Quiz Boards Used

Visitors will be interested in trying their skills in matching names of the various fish with their pictures on one quiz board, and kinds of trees on another. A third quiz board with plastic-embedded specimens will challenge all to identify some of the common animals of the Bay.

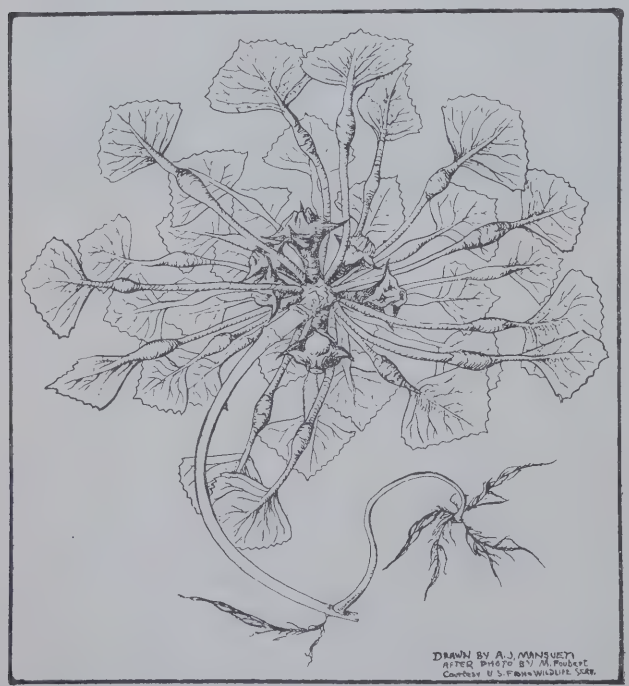
Local Fossils Shown

Fossil collectors will want to see the relatively complete display of the common fossils that have been found in the famous Cliffs of Calvert.—B. L. ASHBAUGH.

FIGHT AGAINST WATER CHESTNUT RENEWED

(CONTINUED FROM PAGE 1)

cooperating departments of the Board of Natural Resources. These were aided by favorable weather and a large proportion of that year's crop of plants was destroyed. Unfavorable weather in 1956 hindered the effectiveness of similar efforts by the limited equipment and personnel available so that a large proportion of the plants matured seed before they could be destroyed. This year an earlier start and more concerted effort is underway. Young plants are being destroyed by cutting the beds with an underwater weed cutter, and by hand pulling scattered plants. As soon as the floating foliage is sufficiently developed spraying with a solution of 2,4-D will commence. Plots will be treated with new experimental herbicides by Federal specialists from the Patuxent Research Refuge in a search for more effective chemicals against this pernicious weed.



Rosette of Water Chestnut Shown from the Underside Which Floats in the Water.

Help By The Public Needed

Stamping out the water chestnut is similar to stamping out a grass fire, for if the very first appearance is attacked the control is easy. Complete removal of the first plant before any seed are produced will prevent further threat from that source. When left undisturbed in a suitable area, a single plant will produce dozens of plants the following season, hundreds the second year, thousands the next, and then acres of plants that soon will invade every portion of the adjacent water suitable to their survival. They can grow in water from a few inches to fifteen feet in depth and, though thriving primarily in quiet fresh water, are able to survive in slightly brackish water almost as far down as the uppermost oyster beds occur. It is important that all interested people report additional appearances of the pest and, if possible, destroy the plants themselves before they can produce seed. The plants are bright glossy green, have small white flowers in mid summer, and should be easy to identify from the accompanying illustrations.—G. F. BEAVEN.

STRIPED BASS TAGGING STUDY UNDERWAY

(CONTINUED FROM PAGE 1)

Atlantic Coast in studying the migrations and habits of these fish.

Study Will Aanswer Several Questions

Before being tagged the fish are removed carefully from the nets one by one, and each is measured, weighed, and a few scales are removed. Such data is valuable in age and growth studies. Three types of tags are being tested in order to determine which is the most suitable for further life history studies. Petersen disks, attached by means of a nickel pin stuck directly through the back of the fish; nylon streamer tags, threaded through the hind portion of the back with a large upholsterers needle and securely knotted; and a stainless steel ring with a red Petersen disk tag attached to the jaws, are the types of tags used. The fish are selected in such a manner that all size groups are marked in about the same equal numbers. In addition to providing the information cited above, details on local movements and general migrations will be forthcoming.

Many 1957 Tagged Fish Already Recaptured

Striped bass of all sizes, ranging from ¼ pound (about 7-8 inches long) to over 50 pounds (roughly 45 inches long) have been tagged and released. Most of the tagged fish range from one to three pounds (12-20 inches). At least 5 percent of the tags attached by biologists from Solomons in 1957 now have been returned by fishermen who caught tagged fish. These were recaptured generally in the areas close to the tagging site, while some were taken as much as 15 to 20 miles from the tagging site. None has yet been reported from outside the Bay. The public will be informed from time to time concerning the progress of this work.—R. J. MANSUETI.

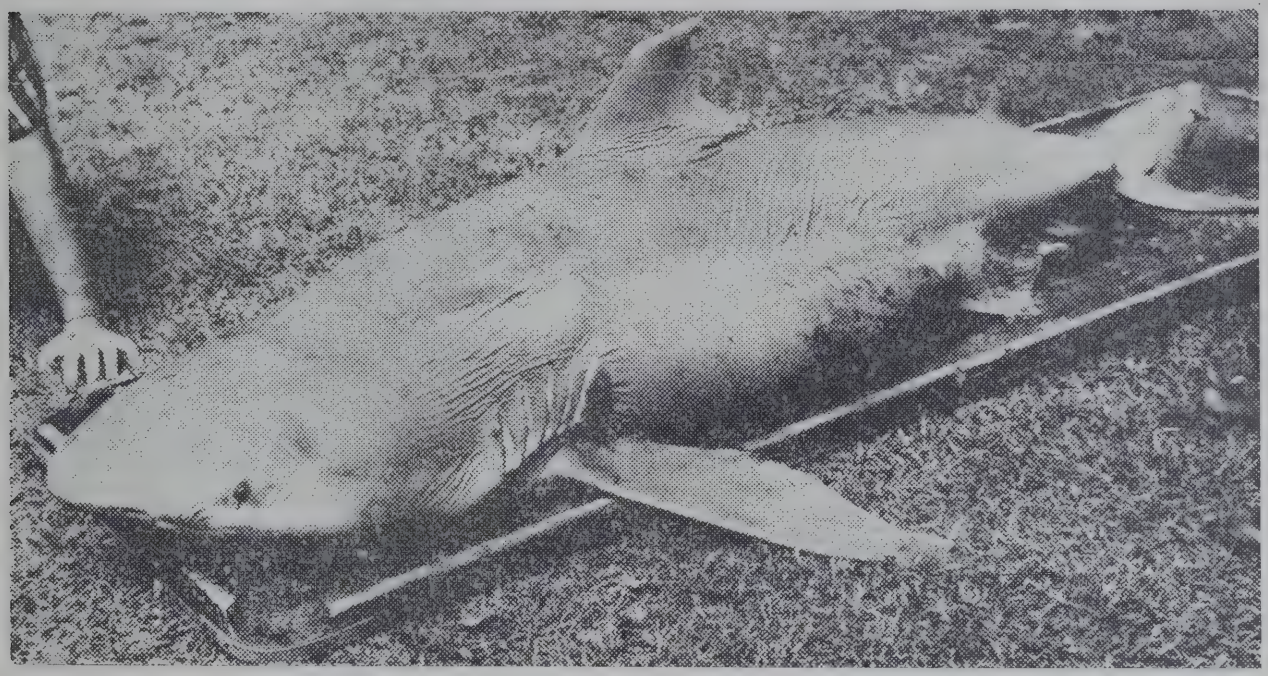
MARYLAND TIDEWATER NEWS

Entered as Second Class Matter at Solomons, Maryland. Office at Chesapeake Biological Laboratory, Solomons, to which all communications should be addressed.

EDITORIAL STAFF: J. R. LONGWELL, J. H. MANNING, E. A. DUNNINGTON, G. J. MURPHY, AND R. J. MUNCY.

Volume 13 JULY—AUGUST, 1957 No. 8

EIGHT-FOOT SHARK BLUNDERS INTO PATUXENT RIVER SEINE



Captured By Haul Seiners

Haul seiners operating in the Patuxent River out of Broomes Island received a surprise visit on July 30, 1957, from an eight-foot shark that tipped the scales at 289 pounds. It was taken during normal seining operations below Parker's Wharf by Captains Jameson Pitcher, Larry Pitcher, Vincent Elliott and William Barnes. When Captain Orem Lowery reported the capture to the Chesapeake Biological Laboratory, their fishery biologists hurriedly lugged the fish back to Solomons where they attacked it with calipers, tape-measures and the latest reference book on sharks.

Identified As Cub Shark

The fish has been tentatively identified as the CUB SHARK, with the tongue twisting scientific name of **Carcharhinus leucas**. It is also called the BULL SHARK and GROUND SHARK. Sharks of this group are notoriously difficult to identify because of the great lack of knowledge regarding variation in body form. There is no record to indicate that this species is a man-eater. Studies have shown that it feeds on crabs, smaller sharks, shad, mackerel, porpoises, devil-rays and sting-rays. Its principle claim to fame is that it is an efficient scavenger, devouring any kind of offal. It also bites readily on almost any kind of large bait of fish or meat.

Never Before Recorded In Chesapeake Bay

The cub shark has never been recorded in Chesapeake Bay and tributaries, although the most famous authorities on sharks in the world, Drs. Henry Bigelow and William C. Schroeder, in their book on the sharks of the Western North Atlantic, state that this heavy, slow-swimming species, is found commonly in shoal water. They also report that they are most often caught around docks, in estuaries and in harbors, and that they run up rivers for considerable distances, sometimes entering fresh water. The cub shark is said to mature at about seven feet in length, but some individuals are known to attain 10 feet or more and the maximum weight recorded for this species is about 400 pounds. The specimen was identified as a male by the occurrence of a pair of curious appendages near the vent called "claspers," which are used in mating.

(CONTINUED ON PAGE 4)

PATUXENT RIVER WOOD DUCK PROJECT

Wood Ducks Being Studied

During the past six months state and federal biologists have been investigating a number of areas on the Patuxent River in an effort to obtain information on the status of the wood duck (summer duck) in this part of Southern Maryland.

Cooperative Venture

This study, a cooperative project of the Maryland Department of Research and Education and the United States Fish and Wildlife Service, has a number of interesting facets. One of the primary purposes is to devise a method by which an index to the wood duck population present on an area may be obtained. This information will be used, however, only as a tool for assessing additional aspects of the study. One of these aspects is to determine the effects of nesting boxes on wood duck populations in selected areas. Nesting boxes have been placed in many other areas, particularly in New England, the Lake States and the midwest, but in most cases no evaluation of their effect has been made. Consequently, this study in the southern portion of the breeding range may prove especially valuable.

Wood Duck Nests In Tree Cavities

Since it normally nests in tree cavities and will readily adapt to nesting in boxes provided for such purposes, the wood duck lends itself well to experiments of this type. If indices to populations can be determined, we can measure changes in numbers brought about by providing these additional nesting sites.

Box Type and Location Important

Still other phases of the study will obtain information on the most suitable locations for the erection of nesting boxes and the type of box which is most effcient in the prevention of predation by raccoons, opossums, mink or snakes which normally prey upon nesting wood ducks or their eggs. To obtain this information the study will probably be conducted for a period of not less than five years since use of nesting boxes by wood ducks increases gradually rather than abruptly following their placement. If results warrant, further investigations may be made.

Censuses Conducted By Boat

To date, the work on this study has consisted of reconnaisance of various stream and river areas and bi-weekly censuses of selected sections. While still very much experimental, these censuses have been made by covering the selected areas by outboard boat and recording all wood ducks flushed or observed, the sex of these birds where possible, and the time observed on special map-like field forms. Generally, these censuses have been conducted during the early morning hours when it is thought wood ducks are more easily observed. Information is then compiled from these maps and the total number of observations and flushing rates per minute are calculated. It is hoped this will provide an index to the population present, particularly during the breeding season when populations are apparently more stable and sedentary.

Future Plans Formulated

Further operations will entail the erection of nesting boxes of various types in differing habitats to provide other necessary data. Censuses will be conducted during the entire course of the study. Since the wood duck has ranked third or fourth in total waterfowl killed in the Atlantic Flyway during the three years prior to the 1956-57 hunting season, the importance of this brilliantly colored bird to the hunters is evident. It is hoped that this study may provide the answers to some current problems and in addition will offer some suggestions for the more intensive management of this important species.—J. R. LONGWELL.

CROAKER MIGRATIONS AS SHOWN BY COMMERCIAL CATCH

The Chesapeake Bay "Gypsies"

The croakers or "hardheads," **Micropogon undulatus,** that left the Atlantic Ocean this year for their annual feeding in Chesapeake Bay, apparently have followed the same old trails of their ancestors. Unlike that old "home-body," the white perch, which usually stays in the river where it hatched, the croaker ranges from the Atlantic Ocean far up the Chesapeake and its tributaries. The routes followed by these gypsies appear to be devious ones, until they are examined in the light of present knowledge. Perhaps the following analogy may help explain these routes.

Croaker Migrations Compared To Those Of Wild Animals (Mammals)

As easily traversed passes through mountains help determine animal trails, so large comfortable water paths of equal salinity within the bay seem to help determine where ocean fish (including the croaker) will move. But just as other pressures cause wild animals at times to take more difficult routes through mountains, so the migrations of the croaker seem to be affected by forces other than desirable salinities. Other factors which appear to affect these croaker movements are:

(a) Large numbers of own or other species with resulting crowding.
(b) Schooling instinct.
(c) Depletion of food and search for replacement foods, etc.

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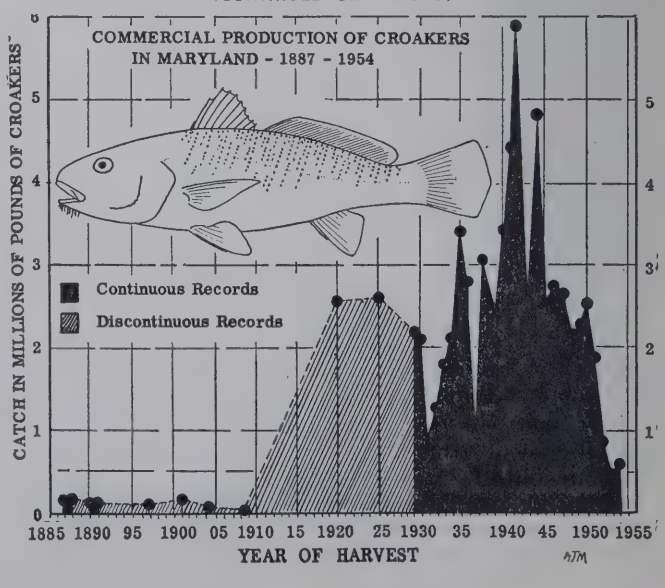

CROAKER MIGRATIONS AS SHOWN BY COMMERCIAL CATCH

(CONTINUED FROM PAGE 2)

During their forced moves to higher and higher altitudes in mountains, wild animals become used to more and more rarified air. Similarly the croaker becomes acclimated to lower and lower salinities in its up-bay and its eastern to western shore movements.

Salinity Gradients Used For This Study

The salinity gradients for the 15 foot average depth of water used for this article were interpolated from those determined by Cruise IV of the Chesapeake Bay Institute April 1 to 25, 1950. These data can be found in Atlas of the Salinity and Temperature Distribution of Chesapeake Bay 1949-1951, H. H. Whaley and T. C. Hopkins—CBI March, 1952. The salinity concentration for each location is expressed as parts of salt per thousand parts of water, e.g. 17 0/00 means 17 parts of salt in one thousand parts of water. These salinity gradients are used only as a guide to show differences between lower and upper bay and tributary waters. Most probably the April 1957 readings are not the same as those of April 1950. In April 1950 the range for the water area studied in this paper was 17 0/00 (one half the salinity of the ocean) at Pocomoke Sound to 1 0/00 (almost fresh water) at Tolchester Beach.

The Croaker Migration—1957

The following pattern of this year's croaker migration is based on the second quarter 1957 catch records of 550 commercial fishermen. Biologists of this Department think the pattern is consistent with the expected annual migration. (All catches used to trace this movement were made in April). Croakers first appeared, in quantities, in the Pocomoke River and Sound early in the month. From the Pocomoke, an Eastern Shore tributary with probably the highest salinities (17 0/00) in the Maryland part of the bay, the croakers moved through Tangier Sound (16 0/00). As the species left Tangier Sound the fish apparently started to scatter somewhat, although there appear to have been two distinct branches to the migration, an Eastern Shore and a Western Shore movement. (If we have a map of the Chesapeake Bay before us, we can trace these movements in some detail). The Eastern Shore group next travelled to the Wicomico River (15 0/00) through Hooper Strait thence to the Little Choptank River (10 0/00). Meanwhile, the Western Shore group had travelled to the Potomac River (12 0/00 to 10 0/00) and the Patuxent River (10 0/00). After their Little Choptank stop, the escaping croakers of the Eastern Shore group then travelled to the Choptank River (10 0/00) and to Swan Point (5 0/00) in Kent County. At the same time the Western Shore group had travelled from the Patuxent past Flag Pond (10 0/00) and Calvert Beach (10 0/00) (both in Calvert County, Chesapeake Bay) to Fort Howard (5 0/00) in Baltimore County. The last catches for April were reported for the Eastern Shore group at Tolchester Beach (1 0/00). **A Word of Caution:** Although for simplification we have shown two branches from Tangier Sound for the migration, this should not preclude that crossing does not occur at other parts of the bay. Neither should it be believed that all croakers enter the Maryland waters of the bay through Pocomoke and Tangier Sounds alone.

What Kind of Croaker Year Is 1957?

This is a question asked up and down the bay by many fishermen. Several biologists of the Virginia Fisheries Laboratory have indicated that, based on their baby croaker studies in 1953-1954, 1957 should be a good croaker year. The following based on commercial catch data only, helps to give a partial answer on the supply of croakers. When we compare catch data for April 1957 to catch data of April—other years, we find that 1957 should be a good croaker year. On what do we base this answer? In analyzing past years' data, we find that in good croaker years, the species is caught above Swan Point (Kent County) early in the season, i.e., in April or May. In April 1957 croakers were caught at Tolchester Beach and Fort Howard, both localities above Swan Point. If other information were available, perhaps the answer to this question would be different. But with this data only, this is the best possible answer to the question at this time. This is the picture as we see it; only complete commercial catch records for 1957 can help prove this year either a good or bad croaker year.—G. J. MURPHY.

LABORATORY TO OBSERVE 25TH ANNIVERSARY

Open House To Be Held

Plans are now being made by the Staff of the Chesapeake Biological Laboratory at Solomons for a celebration August 31, September 1 and September 2 to mark the twenty-five years of its growth and progress since the dedication of the laboratory building in 1932. There will be an "Open House" to which everyone is cordially invited. The Laboratory will be host to the general public on the three consecutive days from 10:00 A.M. to 8:00 P.M.

Brochure Available

A brochure is being compiled to present a brief history of the Laboratory, and it will be illustrated by many photographs depicting marine research in the highly productive area of the Patuxent River and the Chesapeake Bay. Also shown will be studies conducted upon Maryland forests, duck migration, squirrels, fresh water fish, deer, muskrat and upon many other of our animals and plant life.

Many Exhibits Planned

There will be indoor and outdoor exhibits. Those set up in the museum room will consist of labeled specimens in cases showing life histories of the oyster, blue crab and shad. Charts will show the yields from major natural resources and the value of these resources to Maryland. Many other interesting specimens will also be on display. In the courtyard, various gear may be seen which are used in collecting fish, oysters and crabs—such as fish nets, oyster dredges, crab pots and hydrographic gear. The Laboratory boats will be anchored off the end of the pier and will be there for inspection.

Everyone Invited

It is hoped that everyone who can will take advantage of this opportunity to see the Laboratory facilities and exhibits and thus gain a fuller understanding of the work conducted here.—B. W. BRISCOE.

MARYLAND FISHERIES TRENDS, JUNE 1957

Commercial Fishing

Good fishing weather prevailed in Maryland waters during the month of June. More trips were made and generally better seasonal catches were made.

Offshore Fishery Good

At Ocean City, the dragger fleet had a good month with fluke dominating the landings. Bluefish and mackerel appeared in better volume as compared with May with wholesale prices fluctuating from 35 to 40 cents a pound for bluefish and close to 20 cents for mackerel. Sea bass caught by the draggers and pot fishermen were in better supply with the wholesale price of 5 to 12 cents a pound, depending on size and quality. Fluke brought good prices to the fishermen depending upon size and quality also. Surf clam production by the hydraulic dredge fleet remained high with weekly landings in June averaging close to 4,000 bushels.

Alewife Production Near Normal

In Chesapeake Bay and its tributaries most of the pound nets were taken up by the 5th of June, when the shad and alewife (river herring) runs ended. Fishermen and dealers reported a near normal production year on alewives and in most cases a better shad run this year as compared to last year. At the end of the shad run roe shad brought about 12 cents a pound wholesale and buck shad about 2 cents a pound.

Croaker Catches Improve

The haul seine operators in the Rock Hall section of the Bay reported a few more striped bass (rockfish) during June. Wholesale prices fluctuated from 20 to 25 cents a pound. Yellow and white perch catches remained low over most of the Bay area. Croaker catches in the Patuxent and Potomac River areas by haul seine outfits increased considerably during June. Most of the fish in the Potomac were in the ¾ to 1 pound size group, while in the Patuxent River and the Bay the fish were generally a little larger or about 1¼ pounds. For large croakers wholesale prices fluctuated between 10 to 16 cents a pound. Better croaker production was also reported by haul seiners in the Cambridge area on the eastern shore.

Many Hard Crabs Caught

Hard crab production was very good over most of the Bay area during June. Wholesale prices were seasonably high with demand good—both from crab meat picking plants and from the retail trade. Soft crab production in the lower Bay area was seasonably good, while the middle Bay area fishermen reported moderate catches.

Soft Clam Demand Increases

Soft clam dredgers increased their landings during the month to meet the increased seasonal demand. Prices remained stable at $4 a bushel to the fishermen. In Anne Arundel County, where soft clam hydraulic dredging was legalized this year, a fleet of six boats made attempts to catch and sell soft clams. Inadequate equipment on some of the boats and lack of a market for the clams curtailed their activities somewhat. Most of the fishermen, however, feel optimistic about the future of the soft clam fishery.—MARKET NEWS SERVICE, U.S. FISH AND WILDLIFE SERVICE.

"LIGHTNING BUG" TRAPS SMALL CRABS

Lighted Traps Used In Sampling Program

Since early May, the Laboratory pier at Solomons has been the site of some rather strange activities. Many people have shown a curiosity concerning the rather dim glow which they noticed in the water during the evening. Fishermen on the pier have also been perplexed at the large screened box with a light suspended in the center. All of these doings are part of a sampling program started recently at the Chesapeake Biological Laboratory and are aimed at the development of a means of predicting the future abundance of crabs in Chesapeake Bay.

Trap Undergoes Several Changes

The original trap was a double pyramid of aluminum sheet with diamond shaped holes. The light inside produced fingers of light which penetrated outward from the trap for a distance of about eight feet. Apparently the sharp change in light intensity at the entrances was too great, because crabs were attracted to the trap but did not enter it. Currently, we are working with a large screen box, with four large funnels made of the same screen material on the sides. This trap began to attract and catch crabs on the very first trial.

Larger Crabs Do Not Enter

As the crabs grow in size, they tend to approach the trap and, occasionally, cling to the outside. Usually, on first contact, they react after touching the traps by swimming rapidly away, sometimes repeating this behavior many times. In comparison with the reasonably large catches during May and June, the catches during July were very small, indicating that the larger crabs (the average size increased with each sample) are not attracted as are the smaller ones. This program of sampling will be resumed this fall when the smaller crabs again become abundant.

Other Animals Also Taken

Many other animals are taken in number by the trap. Fish, especially silversides, menhaden, anchovies and halfbeaks, are abundant in almost every sample. Shrimp, annelid worms, sea nettles and sea walnuts all find their way or are swept into the trap. It is possible that this lighted trap may have even greater value in sampling small and larval finfish. The program is being continued and further changes in the design are to be made. Progress along those lines will be reported in future issues of the "NEWS."—D. G. CARGO.

EIGHT-FOOT SHARK BLUNDERS INTO PATUXENT RIVER SEINE

(CONTINUED FROM PAGE 1)

Shark To Be Exhibited

After the shark was studied at the Chesapeake Biological Laboratory, it was taken to the food locker at Prince Frederick to be temporarily frozen and stored. It is planned to have the shark mounted by local taxidermists in time to display it at Solomons during the celebration of the 25th anniversary of the dedication of the Chesapeake Biological Laboratory, August 31 to September 2, 1957.—R. J. MANSUETI.

MARYLAND TIDEWATER NEWS

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EDITORIAL STAFF: J. R. LONGWELL, J. H. MANNING, E. A. DUNNINGTON, G. J. MURPHY, AND R. J. MUNCY.

Volume 13 SEPTEMBER—OCTOBER 1957 No. 9

STUDY OF RED SHELLFISH COLORATION INITIATED

Coloration Noted In Processing Houses

Oyster and soft clam packing houses on the Chesapeake estuary occasionally experience a colorful but costly loss through "red oysters" or "red clams." It usually happens like this: oysters or soft clams, apparently no different from any others, will come to the shucking house where they are shucked, processed and placed in containers for shipping. These containers are then stored at 35 or 36° F. The oysters or clams appear to be perfectly normal at this time. After three to seven days at this temperature, some of these cans are found to contain a bright red liquor in the pack, as if the molluscs had been packed in beet juice or tamale sauce. Apparently, these shellfish with red coloration are perfectly safe to eat, but are not well received on the markets; consequently, these oysters and clams are discarded. One packer this year reported dumping "a thousand dollar's worth" of oysters off the end of his dock.

Condition Known Since Before 1900

This phenomenon has been reported along the Atlantic Coast sporadically since before the turn of the century. Many explanations have been offered, but to date no one has demonstrated the cause, or causes, of the red coloration of oysters and soft clams. Pink yeasts which cause a coloration have been isolated and identified from oysters, but apparently this is a different phenomenon. Dr. Thurlow Nelson, of Rutgers University, once traced an outbreak of "red oysters" in the Delaware Bay to the microscopic "plant" **Gymnodinium splendens.** Again, this appears to be a different phenomenon.

Field Conditions Determined From Interviews

Investigations were started at the laboratory this year to track the causative agent, or agents. Red coloration in oysters from the Rappahannock River was reported in late September and the packers experiencing the difficulty were interviewed. Several facts emerged from these interviews:

1. This phenomenon occurs generally in fall or winter.
2. The trouble lasts only a few weeks, with oysters from the same locations giving no difficulty when harvested after this period.
3. Some packers reported these red oysters became "watery."
4. The tongers reported "red water" at times in the center of the Rappahannock River, but have never noticed it over the oyster bars.

Pigment Identification Attempted

A gallon of shucked oysters which showed signs of developing red color was transported to the laboratory on ice for laboratory examination. Two approaches to cultivating the causative agent are being made, (1) the extraction and identification of the pigments, which would tell whether the agent is animal, bacterial or plant in nature, and (2) cultivation in various media. The extraction work is being done by the joint effort of the Chesapeake Bay Institute of the Johns Hopkins University and the Chesapeake Biological Laboratory. Preliminary examinations indicated the pigment was destroyed by heating and by making the solution acid or alkaline, and was not soluble in alcohol, petroleum, ether, acetone or benzene. Technical difficulties were experienced with the extraction procedures and the pigment identification had to wait for further samples from the field.

Results Determined Through Laboratory Analyses

Laboratory analyses were made at the Chesapeake Biological Laboratory with the following results:

1. The red coloration developed in oysters in salt water, but not in oysters placed in distilled water.
2. The red coloration developed in the cold, 35 to 40 ° F, but not at room temperature, 70 to 80 ° F.
3. The red coloration developed in oysters, but not in the usual bacteriological culture media or in oysters sterilized by autoclaving.

Coloration Develops In Maryland Soft Clams

During the first week of October similar difficulties were found in soft clams from the Chesapeake Bay near Annapolis. The U.S. Fish and Wildlife Service Laboratory at Annapolis has begun a study of the microscopic organisms which might produce this coloration. Generally, the same symptoms found in the oysters were found, but the coloration was a deeper red. One-half gallon of shucked clams and a bushel of clams dredged from the same area were returned to the Solomons laboratory for examination. These examinations are still in progress at the laboratory and the Chesapeake Bay Institute. Preliminary results include the following facts:

1. The red liquor from the "red clams" can cause clams from other areas to turn red.
2. About half of the clams from a "red clam" area turn red, the other half remain normal in color when shucked if kept individually.
3. Microscopic examinations showed many microflagellates present, and the possibility that they are causative agents is being explored.

(CONTINUED ON PAGE 2)

OSPREY BAND RETURNED

Osprey Common Bay Bird In Summer

The osprey, locally known as the fish hawk, is a common summer resident of the tidewater portions of Maryland. Its presence is often noted during its flights while searching for food over the waters of the bay. The large nests, generally constructed of sticks, are also quite evident on large dead trees, duck blinds, power line poles and clusters of pilings. The location of some of these nests on blinds and pilings facilitates the banding of nestling ospreys since these structures are readily accessible by boat.

Nestlings Banded Near Solomons

During June 1956, two nests were visited and five nestlings were banded. These nests were located on pilings adjacent to the abandoned Amphibious Training Base near Solomons. Subsequent examination showed that all banded birds had left the nest.

One Band Recovered

In April 1957, a recovery report was received from the Bird Banding Office, U.S. Fish and Wildlife Service, which acts as a clearing house for banding operations in this country. This osprey was banded June 30, 1956, at the previously mentioned location. It was killed February 10, 1957, at San Marcos, Bolivar State, Colombia, on the west coast of South America and was called an 'eagle' by the reporter of the band.

No Record Distance

While the recovery of this band indicates the great distance some ospreys migrate twice each year, it is by no means a record since other ospreys banded in the Chesapeake Bay area have been recovered in the more southerly portions of South America. (See **Tidewater News,** Vol. 12, No. 11).—J. R. LONGWELL.

STUDENTS AID RESEARCH AS THEY LEARN

Department Contacts Students Through Colleges

Summer research aides have contributed valuable assistance to the staff at Solomons during the past years. In return the aides have had the opportunity to participate in various scientific studies on most of Maryland's natural resources. Each spring the Department of Research and Education corresponds with the biology departments of a number of eastern colleges and universities to locate promising undergraduate and graduate students. Interested students upon being recommended by their faculty advisors are considered for summer appointment. Over the past few years, several of the summer positions have been filled by students returning for consecutive years. In addition, these past members of the laboratory among the summer aides act as excellent ambassadors for interesting future assistants in this program.

Experience At Laboratory Benefits Summer Aides

Undergraduate students receive a very modest salary which covers their living costs for a 10 or 12 week period. Graduate students receive a slightly larger income, depending upon their education and experience. Housing facilities at the laboratory allow the students to further reduce their expenses and promotes a group feeling. The primary benefit to both groups is the opportunity to gain first-hand experience on an extremely varied number of projects. In this respect, the laboratory is quite unique, in that research projects range from upland game and freshwater fish to marine invertebrates and vertebrates. Many biological scientists first learned of their own interest and ability in research through such an experience.

Programs Utilizing Summer Assistants

During the summer of 1957, 14 students and two college faculty members participated in this program. A brief summary of their backgrounds and projects will illustrate the diversity of the summer program.

Miss Barbara Goddard of Middleburg College, Vermont, and Miss Eva Stern of Earlham College, Indiana, counted oyster spat on shells which were exposed during the summer and identified the fouling organisms and other animals which were attached to the shells.

Miss Carolyn Weber of the College of Wooster, Ohio, assisted Dr. Ruth Griffith of Hood College, Maryland, in the identification of estuarine phytoplankton.

Mr. Richard Ziegenfuss of the University of Miami, Florida, assisted in crab research by studying the biology of mud crabs from Chincoteague Bay. He also assisted in the construction and operation of a lighted trap which attracted and caught migrating young blue crabs.

Miss Jean Richardson of Florida Southern College acted as receptionist and educational assistant in the Conservation Exhibit at Solomons.

Mr. Joseph Chervenik of the University of Pittsburgh; Mr. Hunter Fadely of Woodrow Wilson School, Virginia; and Mr. William Meredith of West Virginia University assisted in the intensive sampling of a freshwater pond at the head of the Magothy River in a project designed to develop better methods of measuring pond fish populations.

Mr. John Winters of Frostburg State Teachers College acted as an aide in the new project to learn better methods of determining the abundance of deer and their effects on vegetation.

Mr. Grover Butz of the University of Maryland; Miss Pat McLaughlin of the University of Kansas; and Miss Elizabeth Tegiacchi of Keuka College, New York

(CONTINUED ON PAGE 3)

STUDY OF RED SHELLFISH COLORATION INITIATED

(CONTINUED FROM PAGE 1)

Losses to Industry Have Been Minor

Due to the localized and temporary nature of "red oysters" and "red clams," they do not constitute a major economic loss to the industries. Several packers sample the molluscs from their harvesting areas weekly and if red coloration becomes evident from a given area, these shellfish are not harvested for several weeks. This expediency seems to be effective.

More Reports Needed

The problem is intriguing to biologists because the elusive nature of the agent, or agents, has prevented identification for half a century. The sporadic occurrence of this condition hinders its study; therefore, any information, observations or reports of new outbreaks would be greatly appreciated.—D. W. LEAR and J. H. MANNING.

STUDENTS AID RESEARCH AS THEY LEARN

(CONTINUED FROM PAGE 2)

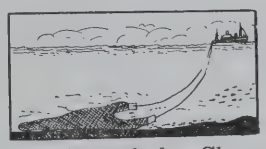
participated in various projects related to striped bass, yellow perch, trout, and other estuarine fish.

Miss Joan Voorhees, a graduate of Hood College, Maryland, assisted in the preparation of biological exhibits for the "Open House" held at Solomons on Labor Day week end.

Dr. Rosemary Hein of Keuka College, New York, continued research on the biology of the sea nettle.—L. E. CRONIN.

MARYLAND AND VIRGINIA BIOLOGISTS COOPERATE ON BAYWIDE FISH-TRAWLING TRIP

Length Of Bay Surveyed



Exploratory fish-trawling from Cape Charles at the mouth to Northeast at the head of Chesapeake Bay was conducted for a four day period, September 16-19th, by biologists of the Chesapeake Biological Laboratory and the Virginia Fisheries Laboratory. The expedition is one of the cooperative scientific fishery studies carried out on the bay to find ways of bringing about better and sustained fishing for recreation and food. Specifically, the survey was also undertaken to investigate methods of determining the relative abundance of resident and migratory fish. Details on the biology of game, food and forage fishes, as well as on other animals found on the bottom, were also recorded.

Small Mesh Shrimp Trawl Used

The **Pathfinder,** the new 55-foot research vessel of the Virginia Fisheries Laboratory, was skippered by biologist William Massmann assisted by biologists Tony Pacheco and Jim Whitcomb. Robert J. Muncy, fishery biologist, and the author from the Solomons Laboratory, cooperated in the collection, identification and processing of the collections. The 24 bay stations were set seven miles apart from the lower Virginia portion to the upper Maryland portion of the bay. The fish trawl, a 30-foot balloon type, with slightly less than one-inch stretch mesh at the bag end, was towed for 15 minutes on the bottom at each station at depths averaging 40 feet with a range of about 15 feet in the upper bay to 80 feet in the mid-bay.

Early Fall Distribution and Species Of Fish

Many important and interesting fish were caught. They were predominantly bottom-dwelling species, although a few surface and shallow water species were caught. In the lower bay, scup, butterfish, gray trout, bay and striped anchovies dominated the catches. In the mid-bay, croaker, spot, silver perch, harvestfish, gray trout, and bay anchovies dominated the catch. In the upper bay, the catch consisted largely of white perch, spot, silver perch, hogchokers, and channel catfish. Gray sea trout and bay anchovies, spot and silver perch, occurred consistently from waters of high salinities near the ocean to almost fresh water at the head of the bay.

Thirty-Six Species Found

Over 5,400 fish were caught during the survey, comprising 36 different species. These were identified, measured and a large number were returned alive to the bay immediately after their capture. A few fish were preserved for future study. The experimental trawl was designed to capture small young fish of fingerling size so that estimates of relative abundance can be made on a seasonal and geographical basis from year to year. Actually, many adult fish were also caught. A systematically arranged list of fish that were caught follows:

COMMON NAME	SCIENTIFIC NAME
1. BROWN SHARK	**Carcharhinus milberti** (Muller and Henle).
2. BRIER SKATE	**Raja eglanteria** Bosc.
3. SAY'S STINGRAY	**Dasyatis say** (LeSueur).
4. BULLNOSE RAY	**Myliobatis freminvilli** LeSueur.
5. ALEWIFE HERRING	**Alosa pseudoharengus** (Wilson).
6. GLUT HERRING	**Alosa aestivalis** (Mitchill).
7. ATLANTIC SHAD (White Shad)	**Alosa sapidissima** (Wilson).
8. MENHADEN	**Brevoortia tyrannus** (Latrobe).
9. BAY ANCHOVY	**Anchoa mitchilli** (Cuvier and Val).
10. STRIPED ANCHOVY	**Anchoa hepsetus** (Linnaeus).
11. CHANNEL CATFISH	**Ictalurus punctatus** (Rafinesque).
12. WHITE CATFISH	**Ictalurus catus** Linnaeus.
13. BROWN BULLHEAD	**Ictalurus nebulosus** (LeSueur).
14. AMERICAN EEL	**Anguilla rostrata** (LeSueur).
15. WHITE PERCH	**Roccus americana** Gmelin.
16. STRIPED BASS (Rock)	**Roccus saxatilis** (Walbaum).
17. BLACK SEA BASS	**Centropristes striatus** (Linnaeus).
18. YELLOW PERCH	**Perca flavescens** (Mitchill).
19. BLUEFISH	**Pomatomus saltatrix** (Linnaeus).
20. PIGFISH	**Orthopristis chrysopterus** (Linnaeus).
21. SPOT	**Leiostomus xanthurus** Lacepede.
22. SILVER PERCH	**Bairdiella chrysura** Lacepede.
23. ATLANTIC CROAKER (Hardhead)	**Micropogon undulatus** (Linnaeus).
24. SOUTHERN WHITING	**Menticirrhus americanus** (Linnaeus).
25. GRAY SEA TROUT	**Cynoscion regalis** (Bloch and Schneider).
26. NORTHERN SCUP	**Stenotomus chrysops** (Linnaeus).
27. HARVESTFISH	**Peprilus alepidotus** (Linnaeus).
28. BUTTERFISH	**Poronotus triacanthus** (Peck).
29. GINSBURG'S GOBY	**Gobiosoma ginsburgi** (Hildebrand & Schroeder).
30. COMMON SEA ROBIN	**Prionotus carolinus** (Linnaeus).
31. SUMMER FLOUNDER	**Paralichthys dentatus** (Linnaeus).
32. WINDOWPANE FLOUNDER	**Lophosetta aquosa** (Mitchill).
33. SMALLMOUTH FLOUNDER	**Citharichthys microstomus** Gill.
34. HOGCHOKER	**Trinectes maculatus** Lacepede.
35. NORTHERN PUFFER	**Sphoeroides maculatus** Bloch and Schneider.
36. TOADFISH	**Opsanus tau** Linnaeus.

—R. MANSUETI.

CHESAPEAKE BIOLOGICAL LABORATORY SET TO PROBE INTO FISH LIFE IN LOWER SUSQUEHANNA

Project Administered By Advisory Committee

Fish life in the lower Susquehanna River and adjacent head-of-Chesapeake Bay will be subjected to intense scrutiny by biologists of the Maryland Department of Research and Education from fall 1957 to spring 1961. This important project, known as the "Susquehanna Fishery Study," was discussed at the first meeting of the Susquehanna Fishery Study Advisory Committee held at Solomons on October 14th-16th. The committee consists of Dr. Daniel Merriman, nationally-known striped bass biologist and Director, Bingham Oceanographic Laboratory, Yale University; Dr. W. E. Ricker, internationally-known authority on fish populations and Editor, Fisheries Research Board of Canada; Dr. A. S. Hazzard, authority on fish management and Assistant Executive Director, Pennsylvania Fish Commission; Stanley Moyer, Assistant Chief Mechanical Engineer, Philadelphia Electric Company; and Dr. L. Eugene Cronin, Director, Maryland Department of Research and Education. The project will be undertaken as a co-operative effort by the Susquehanna Electric Company and this department, which is located at the Chesapeake Biological Laboratory at Solomons, Maryland.

Project To Study Effect Of The Dam On Fish Movements

The primary objective of the project is to provide a sound biological basis for decision as to whether or not a passage, such as a fishway, should be provided for fish at Conowingo Dam. The dam is located near the confluence of the Susquehanna River and Chesapeake Bay in Maryland. The construction of a series of hydro-electric dams during the last several decades along the lower Susquehanna River has raised some very important questions concerning their effects on fish in the river. The study will deal with the kinds of fish and the numbers that reach Conowingo Dam and the estimation of the effects of passage on these fish. It will also be concerned with the basic biology of the fish, population census, spawning, and the effects of dam operation on young and adult fish.

Preliminary Data Have Been Collected

Considerable data are already available at the Chesapeake Biological Laboratory about the fishery problems of this area. Creel censuses of the sport-fishing catch in 1955 and 1957, from the Maryland-Pennsylvania line to Port Deposit, have been carried out by this department in close co-operation with the Maryland Game and Inland Fish Commission. The historical aspects of migratory fish runs, especially of shad, have been documented in detail by the department. Other compiled data describes the physiography of the area as well as other recorded information.

Project Leader To Be Announced Later

The Susquehanna River Project will be under the direction of a project leader trained in fishery biology, as yet not appointed. Although the project will be administered by this department, the Advisory Committee must approve the plans, progress and reports of the project leader.

MYSTERIOUS EEL FOUND IN MARYLAND

Found In Farm Pond

Early in August a branded eel was found in a Harford County farm pond. The mark, which was quite clearly a brand and not accidental, appeared to be "IXI."

Information Needed

Inquiry among biologists from both Maryland and Pennsylvania revealed no one was carrying on experiments with eels. It is hoped that this article will be noticed by whoever has branded the eel and that he will report the fact to us.

Fish Branded

Branding as a method of marking fish has been tried by a number of experimenters, using a technique similar to that used for cattle. Pennsylvania biologists have branded trout successfully, but it requires a trained observer to read a brand mark several years old. This is because the mark becomes diffuse as the fish grows. Eels and catfish, because of their smooth, tough skins, should be among the most satisfactory species of fish to brand.

Migratory Habits Known

Eels spawn in the Sargasso Sea and their young migrate to the fresh waters of both North America and Europe. Very little is known of their migratory habits, if any, after they reach fresh water. If the branded eel found in this Maryland farm pond was released somewhere else, this capture will contribute to our knowledge of this kind of eel migration.—H. J. ELSER.

CHESAPEAKE BIOLOGICAL LABORATORY HOST TO 1,500 VISITORS DURING "OPEN HOUSE"

Laboratory Celebrates Anniversary

A crowd estimated at 1,500 visited the Chesapeake Biological Laboratory at Solomons, Maryland, over the recent Labor Day holiday week end for an "Open House" that celebrated the laboratory's growth and accomplishments in scientific research and education since the doors of its present building were opened 25 years ago. Interest and enthusiasm in the laboratory's progress toward better knowledge of bay resources and their use was shown by the many visitors who journeyed to Solomons from New England, New Jersey, Delaware and throughout the State of Maryland. Exhibits showing research methods and equipment as well as displays of live animals were seen by the visitors. Several scientists from other nations signed the guest register and spent some time conferring with the staff and studying the methods and results of research conducted here.

"Open House" Considered Rewarding By Laboratory

The time spent in preparing these exhibits for the public was an investment well worthwhile. The "Open House" stands out as one of the most successful of the laboratory's educational programs—a rewarding experience both to the staff and to the many persons who took advantage of this opportunity to visit this institution.

MARYLAND TIDEWATER NEWS

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Volume 13 NOVEMBER—DECEMBER, 1957 No. 10

FOREST IMPROVEMENT PROGRAM UNDERWAY

Joint Studies Conducted

Maryland's forestry research program, emphasizing forest tree improvement studies, has now become well established. These studies are conducted jointly by the Department of Research and Education and the Department of Forests and Parks, with cooperation from other agencies.

Selective Breeding Needed

In general, forest tree improvement means investigations into many distinct but closely related fields of endeavor aimed at producing superior trees. For years the common logging practice in this country has been to fell the highest quality trees present in each successive logging operation. This procedure, called "high grading," has continued, with the result that only the poorer quality trees are available to produce the trees of the future. The opposite is true in agriculture, as thinking farmers always use their best animals for breeding purposes in order to build up their growing stocks. The same line of reasoning is expounded by foresters in their efforts to carry out good management practices on the farmer's small woodlot. This also holds true on the large industrial forests, and on the State forests. The most valuable, faster growing, and well formed specimens are favored, while the inferior "cull" specimens are removed. The result is a forest of greater net worth.

Differences Between Trees Are Great

Foresters now recognize the vast differences inherent within any given species. A stand of loblolly pine, for example, will contain individuals varying greatly. Some may have a greater ability for self-pruning of the lower branches. Others will be observed to grow straighter and faster, or produce denser wood, or are more resistant to insect attack, diseases, and climatic extremes. One of the first objectives of a tree improvement program is to impress upon everyone the need to observe and record the location of "plus" stands and superior individual trees. Such trees are necessary to provide seed, cuttings, and pollen in future tree breeding activities. Trees considerably taller, and greater in diameter, than any of their neighbors of the same age, and exhibiting straightness and other good qualities, are classified as "superior" trees. If one is over 50 per cent larger in size than the average of the next three largest individuals in the stand, it is called an "elite" tree. A 25-year old white pine, **Pinus strobus,** growing in a small plantation near Ashton, in

(CONTINUED ON PAGE 3)

MARYLAND'S 1957 OYSTER SET APPEARS SPOTTY

Two Methods Of Checking Set

Each year biologists of the Laboratory at Solomons measure the season's oyster set by two methods. Clean shells in small chicken wire bags are placed overboard at various points and changed about once a week. The shells are then examined under a microscope and the number of spat that have attached during the period of exposure are counted. The information from this method shows when the young oysters set and also how many would attach to clean shells placed in the water at that time. After all setting has ended in the fall, samples of natural cultch and of shell plantings from bars all over the State are taken up by regular oyster gear and the number of spat per bushel counted. This second method gives the actual addition of young oysters each year on the natural rocks, and the number of young oysters per bushel of shells that have been contributed by the regular shell plantings.

(CONTINUED ON PAGE 3)

MARYLAND COMMERCIAL FISHERIES — A REVIEW

Maryland Commercial Fisheries Of Chesapeake Bay Show Apparent Increase For Fourth Straight Year

For 1956 the total production of Maryland's Chesapeake Bay fin fisheries has shown an apparent slight increase of 0.2 per cent over 1955. This compares with apparent increases of 1.6 per cent in 1955; 13.4 per cent in 1954; and 1.4 per cent in 1953. (The increases may be due to more accurate reporting). These conclusions are based on the licensed commercial catch statistics for the respective years. Such constant annual increases seem to indicate that the Maryland bay fisheries are generally in good condition.

Average Price Of Fish Is Stable

The average wholesale price for fish during 1956 was approximately the same as for 1955, 1954 and 1953, at 9¢ a pound. The wholesale prices for carp, catfish and gray trout increased 80, 98 and 17 per cent respectively over 1955 prices. Demand was high for these three species during the year. A good supply of shad along with a moderate demand caused a slight wholesale price in-

(CONTINUED ON PAGE 4)

DEER "FENCE-OUTS" CONSTRUCTED

Experimental Enclosures Started

Plots 1/10th of an acre in size in large, wooded areas are being enclosed by fences to exclude deer in eleven different parts of Western Maryland and the Eastern Shore. This work is a joint project of the Department of Research and Education and the Department of Game and Inland Fish. Each fence will be eight feet high and is part of an experiment to determine the amount of destruction to trees and shrubs caused by the deer population of these areas.

Effect Of Deer On Vegetation To Be Demonstrated

These enclosed plots and surrounding unprotected areas will be regularly inspected for a period of five to ten years to find out what the deer consume and the extent of damage done by this animal. The primary result from these "Fence-Out" studies will demonstrate to hunters and the general public the effects of deer on the forest. Deer feed on nearly all plants in the forest and when the number of deer increases in an area, their browsing can prove very serious to forest resources. A secondary purpose will be the gathering of information on the feeding habits of deer in general. Hunters and others are encouraged to protect these areas and to see that they are kept in good condition.—V. F. FLYGER.

WANTED: SHARKS, SKATES, AND RAYS

Specimens Wanted From Chesapeake Bay Or Atlantic Ocean

In order to fill in or complete various aspects of studies being conducted on sharks, skates, and rays, specimens from Chesapeake Bay, Cincoteague Bay and the Atlantic Ocean off Maryland are needed. Knowledge of catches or any specimens themselves of the species listed below, captured in these areas will be greatly appreciated.

Brown Shark	**Carcharhinus milberti**
Dusky Ground Shark	**Carcharhinus obscurus**
Cub Shark	**Carcharhinus leucas**
Hammerhead Shark	**Sphyrna zygarna**
Bonnet Shark	**Sphyrna tiburo**
Spiny Dogfish	**Squalus acanthus**
Smooth Dogfish	**Mustelus canis**
Angelshark	**Squatina dumeril**
Stingray	**Dasyatis centroura**
	Dasyatis americanus
Say's Stingray	**Dasyatis say**
Stingaree	**Dasyatis sabina**
Butterfly Ray	**Gymnura micrura**
	Gymnura altavela
Bullnose Ray	**Myliobatis freminvilli**
Spotted Eagle Ray	**Aetobatus narinari**
Cownose Ray	**Rhinoptera bonasus**
Eyed Skate	**Raja ocellata**
Brier Skate	**Raja eglanteria**
Barndoor Skate	**Raja laevis**
Little Barndoor Skate	**Raja erinacea**

(CONTINUED ON PAGE 4)

INDEX TO MARYLAND TIDEWATER NEWS SCHEDULED FOR EARLY 1958

Thirteen years have passed since the first issue of the **Maryland Tidewater News.** As with other publications the point has now been reached at which there is need for an index of all previously published volumes. This index is planned for publication early next year. Beginning with the January-February issue of the News, volumes will be numbered from the first of the year instead of, as in the past, with the June issue. Consecutive pagination will be employed and only six bi-monthly issues will form a volume.

The editors need to know how many copies of the index will be required. Therefore, any interested persons or institutions are asked to request copies of this index no later than January 15, 1958. These requests will help us estimate copy requirements.

FISH POPULATION OF ST. PAUL'S LAKE STUDIED BY BIOLOGISTS

Draining Projects Continued

The eleventh in a series of pond-draining projects, the object of which is to study the differences in fish population structure between poor fishing and good fishing ponds, was carried out on November 8, 1957, by personnel of the Maryland Departments of Game and Inland Fish and Research and Education. The pond under study was St. Paul's Church Lake on the Remington Farms near Chestertown, Maryland. This twenty acre pond had been drained and rotenoned in 1951 in an attempt to reduce an overabundant carp population. The present draining revealed that the former effort was entirely successful as no carp were found. This is an excellent example of fishery management accomplishing its purpose. There is still a long way to go, however, before management can produce desired results consistently. It can be expected that management's batting average will rise when it is armed with knowledge gleaned from research activities such as the draining projects.

Bluegills Predominate

Almost two tons of fish were removed from St. Paul's Lake in the 1957 draining, most of which were bluegills. This amounts to 199 pounds of fish per acre, the fourth largest poundage of the eleven ponds drained thus far (the other ponds ranged from 63 to 458 pounds per acre). The total number and weight of fish, by species, is listed in the following table:

Species	Estimated Number	Estimated Weight (lbs.)	Percent by Weight
Bluegills	17,000	2,900	72.5
Gizzard Shad	1,300	550	13.6
Largemouth Bass	640	330	8.2
White Crappies	720	160	3.9
Pumpkinseeds	120	36	0.9
Golden Shiners	470	22	0.5
Brown Bullheads	2	1	0.1
Black Crappies	1	1	0.1
Eels	6	1	0.1
White Perch	1	1	0.1
	20,260	4,002	

Experimental Management Planned

The information on fish population balances obtained from this and other pond drainings in the series will be used in planning the restocking of this pond. Public fishing will be permitted and the pond will be managed as an experimental pond, thus furnishing further information on how to obtain the best fishing in this type of pond.—H. J. ELSER.

FOREST IMPROVEMENT PROGRAM UNDERWAY

(CONTINUED FROM PAGE 1)

Montgomery County, is an example of a superior tree. This specimen is now over 70 feet tall, and has a diameter of 22 inches at a point 4½ feet above the ground. To date, no elite trees have been located in Maryland.

Seed Source Studies Show Racial Variations

Any species may also show variations from one section of its range to another. Seed source tests permit scientific studies of these differences and possible recognition of definite geographic races. When studying racial variations within a species it is important that differences due to local environment, i.e., climate, latitude, soil, etc., are not confused with genetic differences. In order to eliminate these environmental factors as completely as possible, experimental plantations are established. First the seed is collected from many localities throughout the species range and sown at a forest nursery. Then the seedlings are carefully outplanted at the test sites following a precise experimental design. These designs eliminate local differences at the site such as variation in soil and drainage. As the seedlings grow older, hereditary differences may become more apparent. Differences looked for are leaf or needle size and shape, leaf coloration, branching habits, seed size, cone length, growth rate and numerous other characteristics. Seed source studies yield valuable basic information necessary for the further development of any tree improvement program. Such studies for the more important species are well underway throughout the country. The Maryland Program has undertaken the study of racial variation within Virginia pine, **Pinus virginiana.** Progress on this project, now in its third year, will be reported in the next issue of the **Tidewater News.**

Exotic Species Being Tried

Foreign species, or exotics, are being tested to determine their suitability in Maryland for such purposes as Christmas trees, pulpwood and saw-timber. Several geographic races of two exotics, planted on the State Forests in Garrett County, are of special interest to the Christmas tree growers of that area. The needles of some races of Scotch pine turn yellow just before Christmas, unless they are pruned. The desirable Christmas tree should grow about one foot per year, be straight, and remain green during the winter. It is important to learn which races are best for reforestation purposes in our State. The testing of exotics, as well as other aspects of Maryland's forest improvement program, will be discussed further in a later issue.

Foresters Organized For Cooperative Effort

It is evident that no forest improvement program can succeed without an unusual amount of cooperation between all members of the forestry profession and landowners. In order to facilitate such cooperation and to avoid costly duplication of effort, organizations such as the Northeastern Forest Tree Improvement Conference have been formed. These organizations do much toward advancing forestry research. The Northeastern Forest Tree Improvement Conference helps to coordinate research of the Federal and State agencies, private industry, and of individuals from Maine to West Virginia and Maryland. A two-day meeting, held each year, provides an opportunity to both hear of and see research work in progress.—C. D. WHITESELL.

MARYLAND'S 1957 OYSTER SET APPEARS SPOTTY

(CONTINUED FROM PAGE 2)

Natural Loss Of Many Young Spat

The number of spat observed on fixed cultch after the end of the setting season always is considerably less than the number found attached to the clean shells that are changed weekly. There are a number of obvious reasons for this. Natural cultch or shells that have been overboard throughout the season accumulate a multitude of other living creatures such as barnacles, mussels, sea squirts, networks of Bryozoa or tiny "Moss Animals," and many others. Silt or mud also may accumulate in a thick layer over many of the shells. All of these leave much less of the clean shell surface that is needed for attachment of the oyster spat. Also the rapid growth of the other living creatures attached to the shells may crowd out and kill the very young oysters which are less than the size of a fly speck when they first attach. Crowded young oysters may even smother out one another when very thickly set. Certain predators, especially young screw borers, feed upon and destroy many of the young thin shelled oysters.

Time Of Setting Differs By Areas

On the test shells exposed in wire bags the time of setting in 1957 was found to be quite variable. The first spat found attached about June 1st near the mouth of the Manokin River. However, the first general period of setting occurred there and in Holland Straits, Hooper Straits, Honga River, Punch Island Bar, and Smith Creek commencing shortly after the middle of June and generally ending during the first week of July. A second wave of setting in these areas occurred during the first half of August but generally was much less than the early set. In Holland Straits, Hooper Straits and on Punch Island Creek Bar a third and heavier wave of setting occurred during September and early October. No late setting occurred in the other areas studied except near the mouth of the Patuxent River where a light set occurred in the fall.

Quantity Of Set On Natural Cultch

Observations of the state-wide natural set will not be completed until spring. On the areas thus far examined a very light set of 2 to 16 spat per bushel was found on the head of the Bay bars. From Love Point to Poplar Island the set varied from about 24 to 102 spat per bushel, averaging near 50. On bay bars above Cove Point along the Western Shore the set was from 0 to 10, near the mouth of the Patuxent 14 to 30, and 4 to 20 in Cedar Point Hollow. Stone Rock and Punch Island Creek Bars on the eastern side of the Bay had counts of 64 and 112 respectively. In the Choptank, sets on natural cultch varied from 0 to 30. The upper Tangier Sound area had sets ranging from 2 to 60 and the lower Sound had mostly no surviving set at all. Natural set in Holland Straits showed 180 spat per bushel. In the Potomac River the set was 0 on most up-river bars with around 20 per bushel from St. Georges to the river mouth. The observations indicate that only the middle bay along the eastern side has average to slightly above average sets as compared to their past records while the other areas examined were below their average. Most of the tributaries, where setting usually is higher than in the open bay, will be examined early next spring.—G. F. BEAVEN.

MARYLAND COMMERCIAL FISHERIES—A REVIEW

(CONTINUED FROM PAGE 1)

crease of 5.6 per cent. Alewife, croaker, menhaden, spot, striped bass or "rock," white perch and yellow perch, brought the same wholesale prices in 1956 as in 1955.

Important Bay Species Analyzed

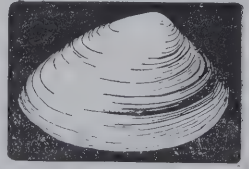
The following species catches increased in 1956 by the percentages shown: Carp—20, catfish—19, croaker—32, shad—45, and white perch—3. The following species catches decreased in 1956 by the percentages shown: Alewife—2, menhaden—29, spot—17, striped bass—17, gray trout—14, and yellow perch—1. Many factors may have contributed to the annual changes in the landings of the above species. Two of the most important factors which surely affected the catch are the availability of these species to the fishery, and the fishing effort for these species. A more detailed study than the present one would be required to determine other factors which helped cause the 1956 changes in production.

Striped Bass Production Analyzed

There is a greater interest in the annual changes of Maryland striped bass production than in the catch fluctuations of any other fish. Sport and commercial fishermen alike examine the trends in this fishery. Because of this interest another study of striped bass fluctuations has been started. The following is a preliminary study on the causes of the striped bass decreased landings, 1956. An analysis of gear data has shown that the actual use of pound nets has declined since 1954. Apparently the large pound nets, which had been destroyed by the hurricanes of 1954 and 1955, were not replaced during 1956. It would seem that this reduction of pound net fishing helps account for some of the decrease in striped bass landings during 1956. When we use the ten-year period 1944-1953 as a base, we find that pound nets accounted for a mean of 29 per cent of the striped bass caught. During 1954 (when some large pound nets were destroyed) pound nets accounted for only 15 per cent of the striped bass catch. During 1955 (when more pound nets were destroyed) pound nets accounted for only 8 per cent of the striped bass catch. Similarly the 1956 pound net catch was only 8 per cent of the total. (With the exception of haul seines which showed a decline in 1956 only, the other kinds of gear showed increases in total pounds caught during these years). Further study may show some other causes for these decreased landings.

Atlantic Ocean Catch Decreases

In contrast to the above bay total catch, the Atlantic Ocean 1956 catch, as shown in cooperative dealer records, showed a 2.3 per cent decrease in total production, and an increase of 9.8 per cent in value. Part of the increase in value is attributable to a 17 per cent rise in the guaranteed wholesale price of surf clams. The decrease in production was caused by drops in the catch of several desirable species—croaker, cod, fluke, and spot. Croaker and spot landings were curtailed by bad weather during September and October—the usual peak production months for both species. The following species of fish showed increases in production: Bluefish, butterfish, porgy, sea bass, sturgeon, gray trout, and whiting. Shellfish that showed increased landings are conch and surf clams. The surf clam fishery, a new one in 1952, has become the ocean fishery of greatest value in Maryland. Surf clams have accounted for 40 per cent of the annual value of the ocean fisheries during 1956 as well as for the three previous years.



SURF CLAM

Other Data Required

As stated before, statistics for the above findings, that pertain to Chesapeake Bay, were based on catch records of licensed commercial fishermen alone. The totals used are incomplete in that they do not include the catch of two other groups—the unlicensed short net and tidewater sport fishermen. With the available data, only gross trends and gross population estimates can be shown for the Chesapeake Bay fishery. Ideal statistics should include every pound of fish caught by licensed commercial, short net and tidewater sport fishermen. Accurate catch records from short netters and from tidewater sport fishermen would help to give more complete species totals. One way such records could be obtained is by licensing short netters and tidewater sport fishermen, and by providing that accurate records would be required from each licensee. Only when the annual species catches taken by all fishermen are known, can scientists make more accurate Chesapeake Bay population estimates of particular species.—G. J. MURPHY.

WANTED: SHARKS, SKATES, AND RAYS

(CONTINUED FROM PAGE 2)

Suggestions For Preserving

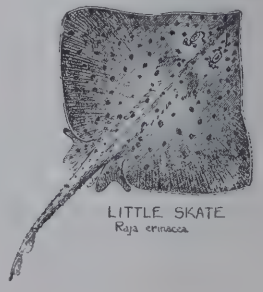
Specimens should be kept alive as long as possible. However, if this is not possible preserve the fish in a barrel containing formaldehyde solution (one part formalin to nine parts water). Cut a one or two inch slit in the right side of the fish so that the preservative can enter the body cavity. The container should have enough preservative to cover the entire fish. Formalin can be obtained at any drug store or will be furnished by this department.

Eggs Or Young Often Lost In Handling

Care in handling the fish should be taken as the shock of capture will often cause the loss of egg cases or young. These should also be collected and placed in a plastic bag (fruit type is satisfactory) and preserved in the above kind of solution. Each fish or group of fish should be kept together with pertinent data of date, location, and how caught. Care should also be taken not to bend the nose of these fish. This is best achieved by placing the fish tail first in the storage container.

Cooperation Of Fishermen Asked

It is strongly urged that fishermen or anyone who normally catches sharks, skates, or rays or any egg cases or young thereof should get in touch with the Department of Research and Education now so that arrangements can be made to assist in the handling of the captured fish. All correspondence pertaining to this matter should be addressed to Dr. Frank J. Schwartz in care of the Chesapeake Biological Laboratory, Solomons, Maryland. — F. J. SCHWARTZ.



LITTLE SKATE
Raja erinacea

MARYLAND TIDEWATER NEWS

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BRIEF SQUID DISCOVERED IN MARYLAND PART OF CHESAPEAKE BAY

Squid Never Before Recorded In Maryland Estuary

Squid in the Maryland part of Chesapeake Bay were discovered for the first time during a bay-wide trawl survey conducted last fall by the Chesapeake Biological Laboratory and the Virginia Fisheries Laboratory. Known as the "brief squid," **Lolliguncula brevis** Blainville, this species has never been recorded in Maryland estuarine waters before, although it ranges in warm waters from Delaware Bay to Florida, the Gulf of Mexico, and Bermuda to Brazil. It is an exquisitely beautiful creature when alive, with flashing large and small spots and patches of red, yellow, green and dark brown studding the body. Dr. Harald Rehder, mollusk specialist at the United States National Museum in Washington, D. C., verified the identification.

Collection Made With Shrimp Trawl

Caught in a 30-foot, balloon-type shrimp trawl at

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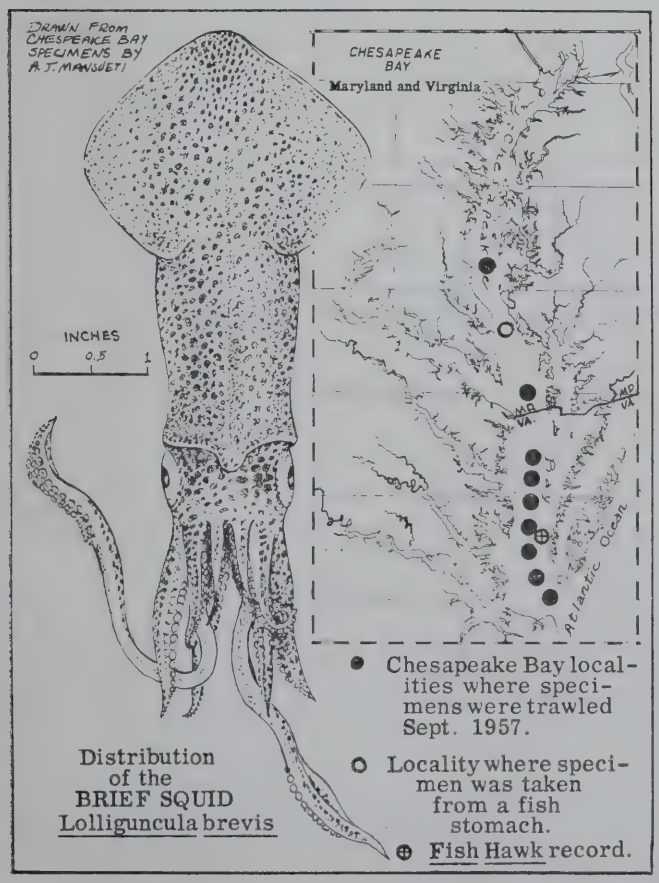


SPECIAL ANTLERLESS DEER SEASON

Special Permits Issued

Forty-seven deer were killed during Maryland's first antlerless deer hunting season on December 11, 1957. This open season was limited to Wicomico, Worcester and the eastern part of Somerset Counties. Fourteen hundred special permits were issued on a 'first come—first served' basis to residents of the above named counties. Hunters killing an antlered deer during the regular season were not permitted to hunt on the special antlerless day, even though they had obtained a permit earlier.

Measurements and Specimens Taken At Checking Stations

Eight deer checking stations were manned by biologists and technicians from the Department of Research and Education and the Game and Inland Fish Commission. Clay impressions of the deer's lower jaw for aging purposes (See **Tidewater News,** Vol. 12, No. 8, 1956) were made and the weights of all deer were recorded. At the Newark and Salisbury checking stations, biologists field dressed the deer for the hunters so that reproductive organs could be obtained for laboratory study. Breeding success as well as the time of conception can be determined by microscopic study of the ovaries. Blood samples and adrenal glands were obtained to be studied. Since studies with other animals have indicated that the weight of the adrenal gland is affected by the conditions under which the animal lives (degree of stress or competition), the examination of these organs may provide information concerning the deer being studied.

Kill Too Small For Detailed Analysis

It had been anticipated that enough deer would have been killed during this special season to alleviate crop damage by deer. Also, the biologists had hoped to obtain enough data from the harvested deer to determine the condition of the herd in affected areas. But the number of deer killed was so small that not enough data was obtained to allow any reliable estimates of the conditions of the herd.—J. R. BOWERS.

ESTUARINE BOTTOM SECRETS EXPLORED BY LABORATORY

Project To Study Dredging Effects

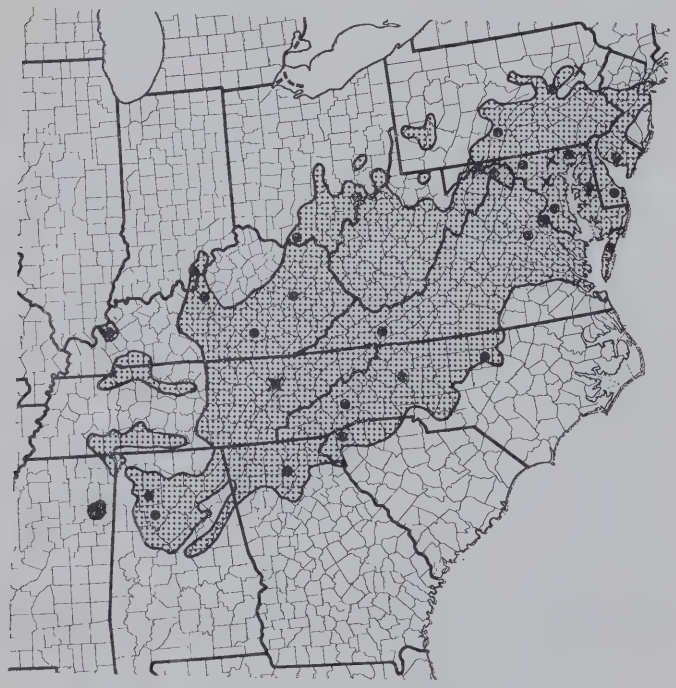
The Chesapeake Biological Laboratory recently entered into a research contract with the Office of Naval Research for a study of the ecology of estuarine bottoms. The project will include studies of the effects of hydraulic clam dredging on the physical and chemical

(CONTINUED ON PAGE 2)

MARYLAND STUDIES AN IMPORTANT PINE SPECIES

Virginia Pine Becomes An Important Tree Species

Virginia pine, **Pinus virginiana,** sometimes called scrub pine, is now considered to be one of the most valuable tree species in Maryland. Such a statement could have been challenged until recently, but its value to the expanding pulpwood industries has earned it new respect. It is now common throughout most of the state, because of its ability to become quickly established on abandoned fields and burned-over areas. Virginia pine now occupies approximately 10 percent of Maryland's 2.9 million acres of forest land. In Southern Maryland it is present on one-fourth of the forested area. Characteristically a fast growing pine, especially for the first 15 years, it should yield one cord per acre per year at maturity on an average site. Although primarily of value for pulpwood, it is utilized to some extent for lumber. Other uses are for Christmas trees, fuel wood, and for net poles and stakes in the tidewater region.



VIRGINIA PINE SEED SOURCE STUDY

Range
Location of Seed Source
× Experimental Plantations - 1957

Virginia Pine Found Over Extended Range

Virginia pine occurs naturally from Central Pennsylvania southward into Georgia and Alabama, and from New Jersey westward into Indiana, excluding the higher elevations. Despite this extended range, relatively little research on it was done prior to World War II. Now that it is more important commercially, several federal and state agencies, in addition to private companies, have become interested in learning more about the growth and management of this pine.

Racial Variation Considered

A study of racial variation within Virginia pine was initiated in 1955 as a major research effort of the Maryland forest improvement program. This program is a joint effort of the Department of Research and Education and the Department of Forests and Parks. (See **Maryland Tidewater News,** Vol. 13, No. 10, Nov.-Dec. 1957). It is important to learn of the existence and nature of any hereditary differences within Virginia pine, as such knowledge is basic for tree breeding studies aimed at improving the species. Seeds collected from some locations are expected to produce seedlings superior in diameter, height, form or in wood properties, while others may be more resistant to climatic extremes, disease or insect attacks. Other differences anticipated are branching habits, needle size and coloration, and the ability to survive under different site conditions.

Plantations Located In Six Areas

Seeds have been collected each fall since 1955 by many cooperating agencies and companies. The seeds collected in 1955 were sown at the State Forest Nursery. Seedlings, representing 16 sources, were outplanted last spring at six locations. Four of these plantations were located in Maryland, one in Pennsylvania, and one in Tennessee. A few months ago, the seedlings were scored for survival and condition, and their height growth was recorded. It was apparent that four of the plantations were very successful and two were failures. The location, cooperator, and percentage survival for each plantation is shown in the following table:

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ESTUARINE BOTTOM SECRETS EXPLORED

(CONTINUED FROM PAGE 1)

characteristics of bottom sediments and the abundance and distribution of aquatic animals and plants.

Seasonal Variation Determined Prior To Dredging

Before the effects of hydraulic dredging can be determined and evaluated, the biologist must be familiar with the condition of undredged bottom, with the populations of plants and animals associated with it, and with variations in condition and abundance of these populations throughout the year. Physical and chemical analyses of bottom corings, ground and aerial survey of aquatic vegetation, and detailed quantitative samplings of the animal populations are required, before dredging and periodically thereafter.

Animals Numerous In Bottom Deposits

Initial survey of an experimental area in the lower Patuxent River is now in progress. The area is divided into four plots, of which two will be left undisturbed as controls and two will be dredged on completion of the initial survey. Bottom corings from these plots are analyzed for percentage of organic matter, total phosphorus, and particle size distribution. Sections of bottom two square feet in area and about six inches deep are removed from the plots and washed through a sieve with one-millimeter (about 1/25 inch) openings. All the animals which do not pass through the sieve are classified and counted. As many as 2,345 animals representing more than 32 species have been found in a single two-square-foot sample.

Continued periodic survey of control plots and dredged plots is expected to result in reliable evidence concerning the effects of hydraulic clam dredging on estuarine bottoms and the associated plant and animal life.—C. B. WHITESELL.

AGE OF FISH REVEALED BY ITS SCALES

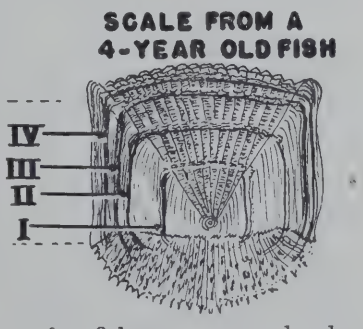
Various Structures Useful For Aging

Determination of age in fish is a procedure which involves the interpretation of annual layers (annuli) that appear in the hard parts of fish. These hard parts include such structures as scales, ear stones (otoliths), spines, vertebrae, and other hard parts. The most important of these structures is the scale because it is considered the most convenient to obtain and usually provides a reliable means of estimating the age of fishes. However, some fish do not possess scales. An example is the white catfish **(Ictalurus catus).** In another instance, a fish may have scales, but the annuli are too vague to be interpreted. The chub mackerel **(Pneumatophorous colias)** is an example of such an instance. In cases such as these, it is necessary to use hard structures other than scales for determination of age.

Plastic Impressions Used

When the scale method is used, it is necessary to obtain a scale sample, make an impression of it, and interpret it. The scale sample is first removed with a knife or a pair of forceps from a location midway between the dorsal fin and the lateral line. Experience has shown that this location yields scales which are most likely to be consistent in uniformity of shape and configuration. These scale characteristics are particularly desirable if the scales are to be used for age determination. After the scale sample has dried, an impression of the scale is made on a plastic (cellulose acetate) slide. The impression is made by placing the scale on a slide and inserting it between the two metal rollers of an adjustable hand press—an operation similar in principle to using the wringer on a washing machine. This method of scale preparation is by far the most popular at present and the plastic slide impression provides an excellent permanent record.

Magnification Of Scales Necessary



The scale impressions from most fish are too small to be examined with the naked eye. This makes it necessary to use a projector which will produce an enlarged image of from 10 to 35 times the normal size of the scale. Certain scale characteristics, some of which are used to determine the age of a fish, may now clearly be seen.

Scales Do Not Grow Continuously

Concentric rings or ridges called circuli appear around a point slightly off center, called the focus. These rings are added one after the other to the outer edge of the scale as the fish grows. Radiating anteriorly from the focus are lines of flexibility, the number of which depends on the amount of body movement necessary in the area where the scale was attached. The large anterior portion of the scale is the part that is attached to the body of the fish, while the smaller posterior portion is exposed to the outside. Upon closer examination of the scale, it can be noted that at various intervals the circuli appear to have stopped growing and are discontinuous. Another circulus, further out, seems to be continuous from one side of the scale to the other and appears to cross over and connect the previously discontinuous circulus. These marks are called annuli. Annuli are caused either by a reduction in the growth rate of the fish due to winter restrictions on environment such as low temperature and less food or to physiological changes that take place at spawning time. In the latter case, the marks generally cannot be traced continuously on both sides of the scale as in the former condition. These marks are called spawning marks or false annuli and are not counted when determining the age of the fish.

Growth Rings Determine Age

Keeping in mind the criteria for true annulus formation, the annuli are counted in the same manner as a forester counts the annual rings on a tree. Beginning at the focus and counting toward the edge of the scale, the first annulus appears where it was deposited after the first summer or year of growth. Counting out

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MARYLAND STUDIES AN IMPORTANT PINE SPECIES

(CONTINUED FROM PAGE 2)

Location	Cooperators	Survival
1. Pocono Mts., Pa.	Northeastern Forest Expt. Station, U.S.F.S. Penna. Dept. of Forests & Waters.	100%
2. Caroline Co., Md.	Glatfelter Pulp Wood Co.	99%
3. Howard Co., Md.	Washington Suburban Sanitary Comm.	98%
4. Baltimore Co., Md.	Baltimore City Bureau of Water Supply.	96%
5. Anderson Co., Tenn.	Tennessee Valley Authority University of Tennessee	2%
6. Allegany Co., Md.	Md. Dept. of Forests & Parks.	0%

Adverse Weather Conditions Influence Success

An outplanting was established in the Pocono Mountains of Pennsylvania for two reasons. As this region is far north of the northern limits of Virginia pine, climatically speaking, its severe weather should serve to accentuate differences in several inherent characteristics, such as resistance to extreme cold, and the date of bud formation. At the same time Pennsylvania research foresters can determine if Virginia pine is suitable for reforestation purposes in their scrub oak areas. High mortality in the Tennessee plantation can be attributed to last summer's drought, as the seedlings had grown well in the spring. Failure of the plantation in Allegany County was partly due to the drought, but the greatest loss came in early winter from deer browsing. Under such conditions efforts to re-establish this plantation are not justified.

Some Differences Already Observed

The scope of this study will be enlarged when seedlings from additional sources are outplanted in 1959. It will be interesting to observe the seedlings representing the more remote outlying areas, because populations there may have evolved under different environmental conditions. Differences between the progeny of individual trees will also be studied in the next field plots. There is evidence, after two years, that racial variation does occur within Virginia pine. It is much too early, however, to describe specific races. Such differences as growth rate, needle coloration, and date of growth termination have been observed, but these differences, and others, may or may not become more pronounced in the future.—C. D. WHITESELL.

BRIEF SQUID DISCOVERED IN MARYLAND

(CONTINUED FROM PAGE 1)

an average depth of about 40 feet, the brief squid were taken between Sharps Island Light (near the mouth of Choptank River, Maryland) and the mouth of Chesapeake Bay. It was recorded from two Maryland stations and at seven stations in Virginia. At the same time the Atlantic longfin squid, **Loligo pealei,** was trawled once at a locality near the mouth of Chesapeake Bay, Virginia. According to Biologist William Massmann, skipper of the research vessel **Pathfinder** from which the collections were made, the small, short-bodied and round-finned brief squid are apparently common in Virginia waters. Curiously enough, the first and only time it was ever identified from Chesapeake Bay in Virginia was in 1953 when Dr. Gilbert Voss, one of the foremost cephalopod specialists in America, critically studied these mollusks in the National Museum collection. He found a collection of over 20 squid dredged from a depth of 80 feet in Chesapeake Bay, two miles west of Cherrystone Light, Virginia, on December 3, 1915, by the old U.S. Bureau of Fisheries fish survey vessel **Fish Hawk.** The first mention of squid in Chesapeake Bay was made by Dr. Voss in his study of Cuban cephalopods published in 1955. Although two species of squid apparently have been collected in Virginia waters, none of the tentative check lists of mollusks for Chesapeake Bay have recorded them.

Recorded At Three Localities In Maryland

The brief squid was trawled at two stations with salinities ranging from 16 to 22 parts per thousand (p.p.t.) in the Maryland part of Chesapeake Bay: (a) off Radar Reference Bell "14," about seven miles north of Smith Point Light in Virginia and (b) about two miles north-northwest of Sharps Island Light. At the Virginia localities where it was taken, the salinities ranged from 21-31 p.p.t. A coincidence is associated with the above mention records. Captain Nat Dare of Solomons, Maryland, caught a 2½ pound gray sea trout, **Cynoscion regalis,** off Hooper's Island, near "Old Rock," on September 29, 1957, that regurgitated a medium-sized brief squid. Captain Dare could not recall a similar occurrence of an entire squid body in fish stomachs in all of his Maryland fishing.

Life History Little-known

Very little has been published about the life history of this dwarf squid. Gordon Gunter, in his study of the Texas Coast invertebrates published in 1950, has given some interesting data about it. For example, Dr. Voss commented that it was difficult to explain the presence of young specimens from depths of 1200 to 1400 feet in Cuban waters, since adults are surface or shallow water dwellers. He stated, "It can only be conjectured that the adults retire to deep water to spawn and that the young continue to dwell in moderate depths until nearing maturity when they seek the shallow coastal waters." The September observations do not fully corroborate his generalizations. Jellylike, transparent masses of squid eggs, probably from the brief squid, since recently hatched individuals were taken with adults, were trawled at four stations in Virginia, one locality about 40 miles above the bay mouth. One locality yielded eggs and a young squid about ½ inch long, although undoubtedly newly hatched brief squid are probably minute like their cousin, the longfin squid. These meager observations are of interest since virtually nothing has been published about spawning, the eggs and young of the brief squid. The most important fact gleaned from the collection of over 100 brief squid is that the wide range of sizes, from fingernail sized individuals to adults almost 10 inches (total length), indicates a prolonged spawning period, extending at least to September in the lower Chesapeake estuary. Further study of the sizes in the catch may indicate several age groups.

Are Brief Squid Native Or Stragglers In Bay

Do these catches represent new records of well-established, native populations or do they reflect stragglers recently invading the bay? Biologists of the Virginia Fisheries Laboratory have observed what they believe to be this species for the last five or more years during their trawl studies, but none was collected for careful examination. The lack of similar extensive surveys in Maryland may account for the latency. Why have not fishermen, oystermen and biologists reported them in Maryland before? The answer may be related to the sparseness of squid populations in past years. It is conceivable that in 1957 a bumper crop of squid plus higher than usual salinities may have accounted for movements up the bay. Salinities have been somewhat higher than usual, a fact that may have also accounted for the unusually high penetration of gray sea trout recorded by our trawl survey and by many fishermen. Presumably there was an unusual invasion of many other marine forms in our estuary. The occurrence of brief squid in Chesapeake Bay should not be a surprise if the statement made by Dr. Voss is true: "This species is more or less confined to coastal areas, bays and lagoons of average salinity and it is seldom recorded in the literature from offshore waters."

Specimens Will Be Identified By Laboratory

The brief squid looks like a stumpy version of the well-known Atlantic longfin squid, which occurs abundantly off Ocean City (See article, "Squid production off Ocean City, Maryland, decreases slightly." **Maryland Tidewater News,** Vol. 11, No. 2, July, 1954).

Anyone capturing squid may send them to the Chesapeake Biological Laboratory, Solomons, Maryland, for identification. Details on locality where it was taken, when and how caught should accompany the mollusk. —R. J. MANSUETI.

AGE OF FISH REVEALED BY ITS SCALES

(CONTINUED FROM PAGE 3)

farther, another annulus can be seen for the second year of growth and likewise, for every year during the life of the fish. If, for example, four annuli are counted in the area from the focus to the edge of the scale, the fish probably can be estimated as being four years old. If there are five annuli, then the fish is estimated to be five years old.

Age Determination Aids Fishery Studies

Determining the age of fish is perhaps the most important phase of the studies about age and growth because age is essential in solving life history problems such as longevity, rates of growth, and age at maturity or spawning time. By obtaining data such as this from samples of fish from different populations, it is hoped that certain predictions can be made concerning the age, size and numbers of fish in future populations.—G. BUTZ.

MARYLAND TIDEWATER NEWS

Entered as Second Class Matter at Solomons, Maryland. Office at Chesapeake Biological Laboratory, Solomons, to which all communications should be addressed.

EDITORIAL STAFF: J. R. LONGWELL, J. H. MANNING, E. A. DUNNINGTON, G. J. MURPHY, AND R. J. MUNCY.

Volume 14 MARCH—APRIL, 1958 No. 2

CONTRIBUTION OF SHELL PLANTINGS TO MARYLAND'S OYSTER PRODUCTION

Cultch an Essential Factor

Why are shells planted by State and private agencies in Maryland waters? To answer this it first should be understood that the presence of suitable "cultch" (oyster shell thus far has proven to be the most practical cultch under Maryland conditions) is a biological necessity for the survival of baby oysters. Fertile

oyster eggs develop into tiny free swimming larvae that travel with the tides for about two weeks. At the end of this period they must cement themselves ("set") on a firm object, usually an old shell or a living oyster, that will support them above the bottom. They are unable at this stage to survive in or upon the layer of silt that exists even in firm bottom. Upon cementing themselves they make certain body changes (metamorphosis) through which they become the oyster with which we all are familiar. Without suitable cultch no young oysters can be produced.

Many Other Factors Influence the "Set"

Bare shells obviously cannot receive a set of young oysters or "spat" unless oyster larvae occur in the water where they are planted. This means that there must be brood oysters to produce enough larvae for satisfactory setting. In some areas brood oysters have become extremely scarce. In other areas there are abundant brood oysters but the larvae become so scattered through strong tidal mixing that few are left over the bar where cultch is available. At times quantities of barnacles, **Bryozoa,** and many other forms of attached marine growth, as well as silt, may cover the shell surfaces before the oyster larvae are ready to attach. These and other factors greatly influence the quantity of oyster set upon the shells and at times may prevent any set at all.

Shell Plantings Useful in Two Ways

Before man began to harvest them, all oysters completed their lives and died upon the bottom where they had set. Their shells thus continuously added to the cultch upon the oyster bed. Continued and in-

(CONTINUED ON PAGE 8)

CONSERVATION WORKSHOP ANNOUNCED

Cooperative Program with University of Maryland

The College of Agriculture, University of Maryland, will cooperate with the Educational Division of the Maryland Department of Research and Education in developing a workshop devoted to the study of the state's basic wealth, its natural resources.

Conservation Specialists to Assist

The six credit course, designated as Rural Education No. S 170, is at the graduate as well as undergraduate level and will be in session from June 23 to August 1, 1958, on the campus of the University of Maryland. Instruction will be under the supervision of Mr. Byron L. Ashbaugh of the Maryland Department of Research and Education. He will be aided by specialists in various conservation activities from state and federal governments who will lecture and act as consultants throughout the course.

Field Trips Scheduled

A number of field trips are scheduled to representative areas of each of the state's physiographic regions. During these trips opportunities will exist for taking photographs, making nature collections and the assembling of teaching materials. As a result of these field trips, an appreciation of natural resources will be developed through first-hand observations.

Teaching Methods to be Evaluated

In addition, teaching aids will be evaluated, and effective methods of teaching conservation will be studied. Training will be given in group activity skills which will enable teachers to convey effective knowledge relative to resource-use principles and concepts. Adequate opportunities will be provided for students to locate management problems and develop logical solutions.

Some Scholarships Available

A number of scholarships covering the cost of the workshop will be available. Teachers interested in applying for these should write to the Director, Office of Scholarships, University of Maryland, College Park, Maryland.—B. L. ASHBAUGH. 5

CRABS RETAIN DYE FROM STAINED FOOD

Marking of Crabs a Research Tool

The tagging or marking of small crabs is a sorely needed research tool if long range predictions of future stocks are to become a possibility. Efforts along these lines have been made by other workers in the past. In most cases, tagging with metal or plastic tags, marking by hole punching or injections of dye have worked well on captive animals but have not been successful when the animals were released in a natural environment. In some cases, the marking techniques have caused death to a large proportion of the animals treated.

Marking of Shrimp Successful

Late last fall, the work of a research biologist in Texas was published which gave an account of feeding stained food to shrimp. Certain of these techniques were extremely successful with the shrimp absorbing the color to a marked degree, suffering little or no ill effects and even retaining the color through several molts or sheddings. Since shrimp are more or less transparent, the markings showed up quite distinctly in experiments with them. This same method may not work as well with the blue crab because of its dark green shell and various shades of blue, white, and red on other parts of the body which may mask the dye.

Crabs Fed Stained Fish

Last winter, some exploratory work was begun at the Chesapeake Biological Laboratory to determine if this technique would be effective in marking blue crabs. A number of small crabs were fed pieces of fish which were stained a dark red with Neutral Red, a dye that is easily dissolved in water. The crabs ate this food freely and showed no apparent signs of noticing the color. Unstained food, given at the same time, was taken at about the same rate. Three feedings of stain-

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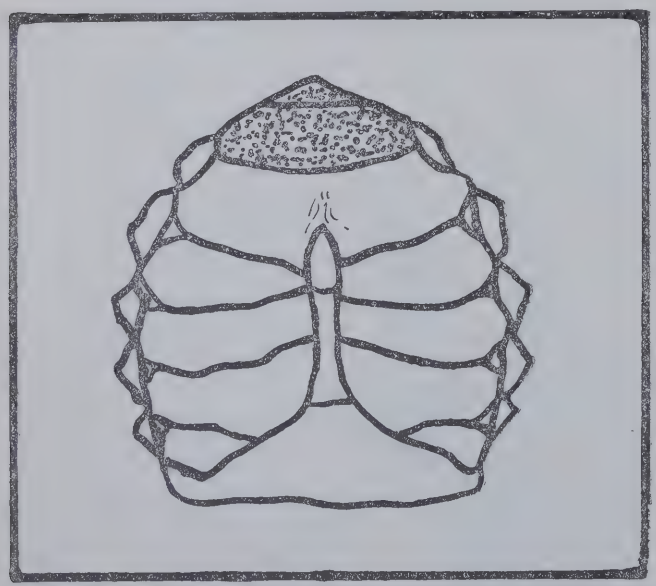


SHADED AREA SHOWS LOCATION OF DYE CONCENTRATION

NOTES ON MAMMALS OF CALVERT COUNTY, MARYLAND

A study of the mammal fauna of Calvert County has been undertaken by staff members of the United States National Museum with the cooperation of Dr. Romeo Mansueti and the Chesapeake Biological Laboratory. The primary purpose of such a study is to contribute in this particular field to our knowledge of the world in which we live. The systematic study of mammals involves the gathering and orderly arrangement of facts about how many kinds there are, where each kind lives, and what are their relationships to each other. These investigations are also of importance to medical scientists who study the various disease-causing parasites that infest mammals. In the course of this investigation, we hope to determine what species occur in Calvert County, their exact distribution, and their relationships to mammals of other areas.

Calvert County is of interest to mammalogists since it seems to be an area in which northern forms of many species meet and intergrade with southern forms. If such regions of intergradation and the characters of the intergrading populations are known, we can more clearly define the ranges of the various subspecies.

From December 16 to 20, 1957, Dr. Henry W. Setzer and the author visited the lower county and made preliminary collections at the following places: the old Amphibious Training Base north of Solomons Island, the hemlock woods along Hellen Creek, the Cypress Swamp along Battle Creek, the Drum Point area, Solomons Island, and a densely vegetated field two miles east of Route 2 on Scientists' Cliffs Road. More than eighty specimens of mammals were collected and preserved for study in the United States National Museum. The following kinds of mammals were taken:

Short-tailed shrew **(Blarina brevicauda)**: This small, grayish-black, mole-like mammal is common in fields, woods and swamps, probably throughout the County. Specimens were taken at all trapping localities.

Lesser short-tailed shrew **(Cryptotis parva)**: This shrew is very much like the preceding species but is smaller and more brownish. It is fairly common in old grown-up fields and occurs together with the short-tailed shrew in this type of habitat. It should also be looked for in marshes. All our specimens came from the old fields at the Amphibious Training Base.

Common mole **(Scalopus aquaticus)**: One specimen, taken four miles north of Solomons by Dr. V. F. Flyger, was presented by the Chesapeake Biological Laboratory.

Gray squirrel **(Sciurus carolinensis)**: Two specimens, taken by Dr. V. F. Flyger in the Little Cove Point area, were presented by the Chesapeake Biological Laboratory. They seem to be fairly common in the County, being seen several times in woods and along roads north of Solomons.

White-footed mouse **(Peromyscus leucopus)**: This native, long-tailed, brown mouse with white underparts is very common in wooded areas. It was taken at the hemlock forest, the cypress swamp, the Amphibious

(CONTINUED ON PAGE 7)

PROGRESS ON SOMERSET BOTTOM SURVEY REPORTED

Progress Described In Study Report

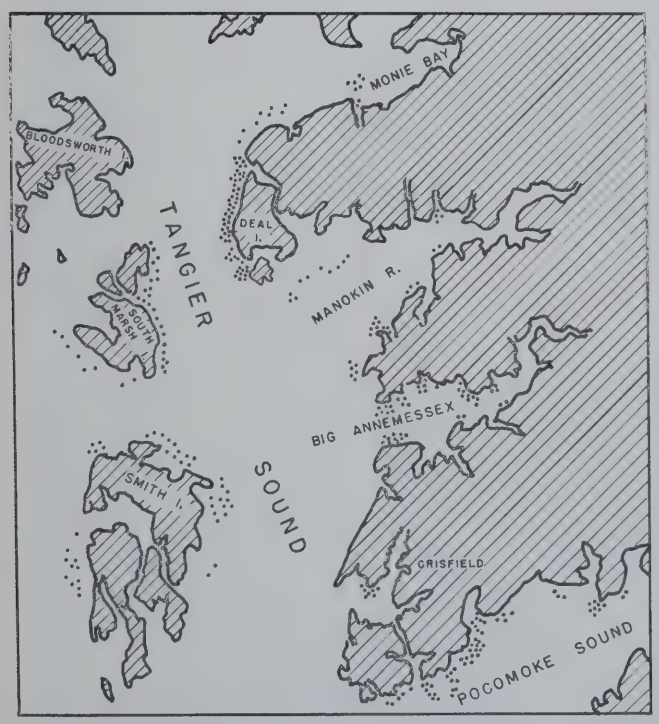
Progress on the exploratory survey of tidewater bottoms of Somerset County during the period October-December 1957 is described in Resource Study Report No. 12, recently issued by the Maryland Department of Research and Education. The purpose of the survey is to determine whether soft shell clams are abundant enough to support a commercial dredge fishery.

Hydraulic Clam Dredge Used For Sampling

More than 300 bottom samples were taken with the hydraulic clam dredge in areas where the water was three to nine feet deep. Many shoal areas, including several said by local watermen to have been good clamming shores in past years, could not be reached during the survey. Commercial quantities of clams were found in a few scattered samples along the western shore of Deal Island; in the Lower Thorofare area samples indicated that there are enough clams to support a very limited amount of commercial dredging. Small quantities of clams and substantial numbers of clam shells were found in more than a third of the areas dredged.

Hurricanes May Have Reduced Clam Populations

Growth rate of the soft shell clam in the Tangier-Pocomoke area appears to be about the same as that of clams in the Patuxent River and other Maryland waters, where the minimum legal length of two inches is reached in about 16 to 22 months. Observations indicate that natural enemies may greatly reduce the numbers of young clams, which before burrowing are easy prey to crabs, waterfowl, and other predators. There are also indications that Somerset clam bottoms may have been severely damaged in the hurricanes of 1954 and 1955, as were many oyster beds.



SOMERSET COUNTY BOTTOMS
SURVEYED OCTOBER-DECEMBER 1957

EACH DOT (•) REPRESENTS ONE SAMPLE

Further Study Planned

Results of the survey thus far do not indicate that Somerset waters now have a commercially important crop of soft shell clams, but observations are thought to warrant further study and exploration. Extension of the survey into the shallow, protected waters of the minor tributaries and embayments is planned during the summer of 1958.—J. A. MANNING.

NOTES ON MAMMALS OF CALVERT COUNTY, MARYLAND

(CONTINUED FROM PAGE 6)

Training Base, and the Drum Point area.

Pine mouse **(Pitymys pinetorum)**: One specimen of this short-tailed, velvet furred, burrowing mouse was taken in the hemlock forest along Hellen Creek. Since specialized trapping techniques are required for collecting this species, the fact that we took only one specimen does not necessarily indicate their scarcity here.

Meadow mouse **(Microtus pennsylvanicus)**: This large, chunky, short-tailed, dark colored mouse was common in open fields. Their runways, cuttings, and droppings can be seen when the grass is parted. They were taken in thickly overgrown fields near Drum Point and on Scientists' Cliffs Road.

House mouse **(Mus musculus)**: This mouse, a native of the Old World, has been introduced into America and is now widely distributed. It is generally associated with human habitations but is frequently found in a feral condition. It was trapped in the fields at the old Amphibious Training Base, at Drum Point, at Solomons Island, and at Scientists' Cliffs Road.

Norway rat **(Rattus norvegicus)**: One specimen of this introduced, Old World rat was taken at Solomons Island. We were told that it is found in stores, warehouses, and homes in the town. It is usually associated with barns, warehouses, or human dwellings. Many other species that were not taken in this preliminary survey also occur in Calvert County. Additional collecting is planned, particularly in the central and northern parts of the County.—JOHN L. PARADISO, U.S. National Museum.

CORRECTION:

Maryland Tidewater News, Vol. 13 (10) Nov.-Dec. 1957, Page 3, column 1, lines 38-39 should read: "The needles of some races of Scotch pine turn yellow just before Christmas. Also, many individuals of this fast growing species are too sparsely branched to make ideal Christmas trees, unless they are pruned."

CONTRIBUTION OF SHELL PLANTINGS TO MARYLAND'S OYSTER PRODUCTION

(CONTINUED FROM PAGE 5)

tensive harvesting has interrupted this natural accumulation and, as older shells broke down or were silted over, many former oyster beds now have very little suitable cultch upon them. Where it is known that larvae will set in sufficient quantity, and it is decided to utilize the local set for a crop of adult oysters, then shells can be planted directly upon the beds and left there for maturity of the set that they receive. Where it is known that oyster setting is sparse, or almost absent, shells can first be planted elsewhere where the rate of setting is known to be unusually high. Areas of this nature are called "seed areas." After the spat have attached, the shells are taken up and planted as "seed" on beds where they are to grow to maturity. Production based upon seed oysters has the advantage of even-aged crops in the right concentration but involves more expense because of the transplanting from seed areas to growing areas.

Determining Yields from Shells

Yields from private shell plantings can easily be measured by the books of the planters, but yields from plantings on public bars are difficult to measure since the crops produced are usually combined with those from natural or unplanted areas. It is possible, however, to judge the expected yields by applying a knowledge of the normal natural setting rate where the shells are planted, the rate of growth, and the average normal mortality. We know that it takes 350 oysters of 3½ inch length to fill a bushel. In most places a 3½ inch size is reached at a little over three years of age or during the third autumn season. The normal death rate among young oysters seldom exceeds 10 per cent per year after the first autumn (when the set is counted) under most Maryland conditions. Also clean shells planted at the beginning of the summer will usually catch about four times as many spat as will old cultch. Oyster research studies have produced a reasonably good picture of the average rate of setting on old or natural cultch in most Maryland waters during the past fifteen years. By applying the above knowledge we can calculate how long it will take to produce a bushel of marketable oysters from a bushel of planted shell under various rates of setting on natural cultch. Thus it will require an average setting rate on old cultch of about 125 spat per bushel (equivalent to 500 spat per bushel on clean shells) to produce a bushel of 3½ inch oysters on planted shells by the third season, or about 45 per bushel to produce the same amount within 10 years, and at a natural setting rate of only 20 spat per bushel it would take about 24 years for a bushel of 3½ inch oysters to have been produced for one bushel of shell. The above figures apply only to early summer planted shells on hard bottom. Shells that settle in the bottom or become badly fouled before any oysters set will produce much less.

Profits From Shells Vary

Since the average amount of oyster set varies greatly throughout the State, and from year to year, the relative success of shell plantings can be expected to show great differences. Large areas along the western side of the bay and in the upper portion of certain major rivers have been found to average less than 20 spat per bushel and shell plantings can seldom pay in such locations. Other large areas with slightly higher sets require fairly long periods for the shells to pay for themselves, while in a few areas, mostly certain tributary waters, sets of 125 or more are normal and here shell plantings sometimes produce excellent yields. There have been numerous instances of individual failures and marked successes. Where to locate specific shell plantings, and whether or not to use shells for seed production or direct yields, are decisions that involve many practical and political considerations. For over a century the original oyster beds of Maryland were stripped of oysters and shell before any attempts at rehabilitation were made and the decline in production was rapid. The combined efforts of State and private planting at present cover only a small percentage of the acreage of charted and potential oyster bottom. Without the shell plantings of the past quarter century, however, Maryland oyster production would have fallen much below its present level. Continued efforts in the increased and most effective use of oyster shell and of substitute cultch, both by the State and private planters, constitutes an essential step in the building up of Maryland oyster production.—G. F. BEAVEN.

CRABS RETAIN DYE FROM STAINED FOOD

(CONTINUED FROM PAGE 6)

ed fish were made within a period of seven days and the crabs were then kept for a period of six weeks. Weekly feedings of unstained fish were made. The crabs were then preserved in alcohol and the color noted. It was observed that a bright red color was concentrated in the under surface of each crab, immediately behind the mouth. Certain of the larger crabs, which did not have access to the stained meat, did not show this color. One crab which escaped while the crabs were being preserved was found in a dried condition several weeks later. This crab exhibited the same concentration of red color as had the preserved specimens.

Study to Continue

This study will be continued this spring when crabs once more become available. Careful control of the staining and feeding operations as well as comparing the crabs using stained fish with those fed unstained fish will tell us whether this will serve as an effective method of marking crabs. Since this mark is not an obvious one to those who are not looking for it, this method will be used in localized experiments conducted by laboratory personnel. Unlike tagging programs which often ask the cooperation of the commercial watermen for the return of tags, this type of marking application will negate such assistance. The dye is non-toxic and is confined only to the crab which feeds on the stained fish. The maximum length of time the dye will remain with the crab is not known. Future issues of the News will carry more information on the effectiveness of this type of marking of blue crabs. —D. G. CARGO.

MARYLAND TIDEWATER NEWS

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EDITORIAL STAFF: J. R. LONGWELL, J. H. MANNING, E. A. DUNNINGTON, G. J. MURPHY, AND R. J. MUNCY.

Volume 14 MAY—JUNE, 1958 No. 3

MARYLAND'S OCEAN COMMERCIAL FISHERY — 1957

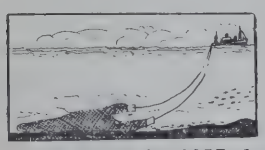
Commercial seafood production for Ocean City, Maryland, showed apparent declines of 7 percent in weight and 9 percent in wholesale value, when 1957 totals were compared to those of 1956. These fluctuations appear to be normal for the ocean fisheries and the totals approximate the 13 year mean weight and value (base years 1944-1956). The 1957 statistics, as in past years, were compiled by the Maryland Department of Research and Education at Solomons from the records of licensed commercial fishermen and cooperative dealers.

Important Edible Finfish Totals Changed

The catch in pounds and in wholesale value of butterfish, croaker, sea bass, sturgeon, gray trout and surf clam reflected this general decline. Contrary to this, the totals for bluefish, fluke, porgy, spot, whiting, industrial fish (listed as other) and conch rose during 1957. Spot showed the greatest increase for an edible fish species, when the catch rose to two and one-half times the 1956 catch. The croaker catch for the year dropped to one-half that of 1956.

Marketing Changes Adversely Affected Surf Clam Catch

Two changes in marketing have affected the fishery. One change, that of lower demand, caused a decline in surf clam fishing effort and catch. This decrease in fishing effort and the resulting lower catch were due to internal changes of the industry, rather than to any depletion of surf clam beds. The evidence indicated that the surf clam beds can support the same amount of fishing as practiced since 1953, because trip catches were maintained at high levels by the active dredgers. Nevertheless, the 1957 total catch and wholesale value amounted to approximately three-fourths of the 1956 totals. The surf clam, which each year since 1953, except for 1955, had ranked first in value of all seafood produced at Ocean City, dropped to second place in 1957, below fluke. From 1953 through 1956 the surf clam accounted for 40 percent of the annual value of the Maryland ocean fisheries. (See **Maryland Tidewater News**—Volume 13, No. 10, Nov.-Dec., 1957). In 1957 the surf clam value dropped to 33⅓ percent of the grand total.



"Trash" Fish Now Being Sold

The second change in marketing involved the industrial or "trash" fish production. Included in this classification are kinds of fish not generally used for human consumption, some examples of which are skates, sea robins, menhaden and anglerfish. Tradi-

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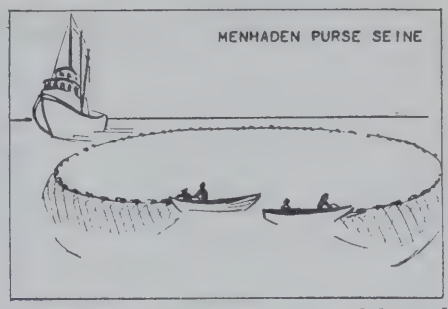
PURSE SEINES ACCOUNTED FOR ABOUT 50 PERCENT OF ANNUAL U.S. FISH CATCH



Nearly 14 million fish hooks of assorted sizes, and more than one million crab, lobster, and crawfish pots of sundry design and description, are part of the fishing gear used to capture the fish and shellfish for the United States consumer.

But despite these imposing numbers only about 11 percent of the annual fish harvest is taken by these types of gear, U.S. Bureau of Commercial Fisheries reports. It is the purse seine and the otter trawl which not only bring in the poundage of food fish, but of industrial fish as well.

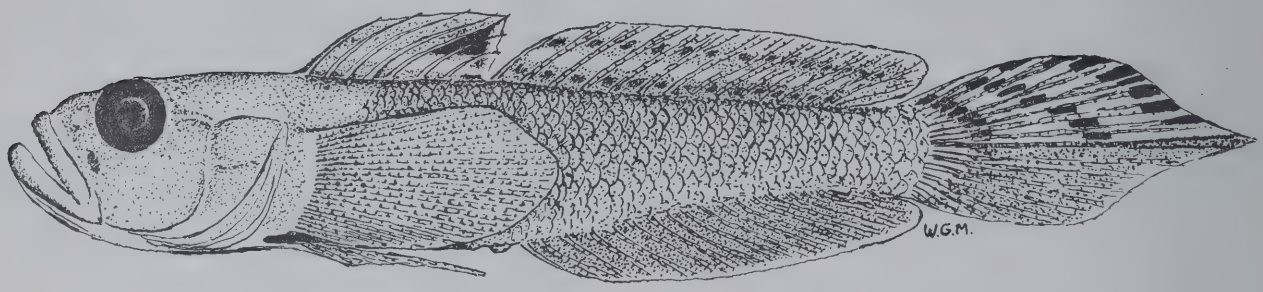
The purse seine, which is used to encircle the schools of fish, brings in about 2.4 billion pounds of fish annually, or nearly half the total harvest. Much of this poundage is menhaden but there is included in the total large amounts of salmon, tuna, mackerel, and Pacific sardines. Nearly 2,400 such seines are used.

The otter trawl, a name applied to several types, is towed over the bottom to catch many bottom-dwelling species—cod, haddock, ocean perch, flounders, whiting, and shrimp. There were more than 9,000 trawls in operation in 1957. It accounts for about one billion pounds annually or 20 percent of the catch.

Records show that the various hook-and-line combinations in recent years caught more than 450 million pounds of fish per year. The take with the lobster pot and kindred gear has been averaging about 120 to 130 million pounds a year. The total annual harvest of all fishes for the last few years has approximated 5 billion pounds, sometimes a bit higher, sometimes lower.

An average of 28,000 gill nets are responsible for 4 percent of the catch; 3,300 pound nets, which include fish traps, take 3 to 4 percent. Shellfish dredges bring in an average of about 100 million pounds of clams (meats), crabs, oysters (meats), and scallops (meat); the balance is divided between "stop" seines (used to cut off the retreat of fish entering coves), haul seines, and miscellaneous gear. MARKET NEWS SERVICE, U.S. FISH AND WILDLIFE SERVICE.

The Scaled Goby, Microgobius thalassinus, a recent record from the Patuxent River, Maryland



1/4 in.

Microgobius thalassinus (Jordan and Gilbert) ♀

Total Length 45.4 mm.

Specimen Is Described

On April 21, 1958, a female specimen of the scaled goby, **Microgobius thalassinus** (Jordan and Gilbert,) 45 millimeters total length, was dredged up from 30 feet of water over the Sandy Point oyster bar about 800 feet offshore from the Chesapeake Biological Laboratory pier. This slender fish, tan with orange-tinted body, (Figure 1) was noted to have a yellow-gold eye and iris, yellow throat, yellow and black spotted nape, colorless pectoral and pelvic fins (base of pectoral fin is tinted orange) and a dusky clear-edged anal fin. The upper portion of the caudal fin has two vertical rows of spots, the first (closest to the body) is orange while the other is yellow. Posterior of these 2 rows, 8 orange spots tip the edge of the fin, alternating toward the extreme tip between orange and yellow spots. The lower half of the caudal fin is dusky with the edge clear. A mid streak of orange runs the length of the caudal fin. The second dorsal fin has orange spots on a dusky background between each fin ray along the lower third of this fin. The middle third has yellow and orange tinted spots between each clear fin ray while the upper third of the fin is spotted orange on a clear background. The lower third of the first dorsal fin is dusky with a yellow base and orange spots between each spine. The middle third of the fin is clear while the upper third is dusky spotted throughout and edged in white. Two conspicuous black wedges occur between the 5th-6th and 6th-7th dorsal spines. The posterior edge of the first dorsal has a yellow spot in the upper part of the fin. A large orange spot occupies the lower third of the posterior edge.

Name Confusion Occurred In Past

The history of the name **Microgobius thalassinus** is interesting in that although it was first so named and described in 1883 on the basis of two specimens off South Carolina, the name was forgotten. In 1888 Eigenmann supposedly described a new species as **Microgobius eulepis** using a specimen 1.87 inches long from Fortress Monroe, Virginia. In 1907 Smith, with a goby 1.75 inches long from Uncle Israel Shoal, Beaufort Harbor, North Carolina, described another species as **Microgobius holmesi.** The famous work on Chesapeake Bay fishes written by Hildebrand and Schroeder in 1928 recognized **M. eulepis** and **M. holmesi** but failed to note the existence of **M. thalassinus.** It was not until 1934 that Isaac Ginsburg of the United States National Museum restudied this group of fish and resolved the problem. The black wedged dorsal and dusky anal finned **M. eulepis** is the female and the spotted edged dorsal and anal finned **M. holmesi** is the male of the earlier described **M. thalassinus.** So great had been this difference in the external appearance of these two fishes that it long confused many people. Today the confusion of names is gone but much remains to be learned about this interesting little fish.

Small Size Reduces Chances of Capture

The distribution of this small goby (fishes with fused pelvic fins) in Chesapeake Bay is interesting. Because its small size, two inches or less, readily permits it to pass through a seine or to be overlooked, it may occupy an area greater than is currently known. Within Maryland waters of the Chesapeake Bay the scaled goby is known from the following sites. On April 28, 1922, two specimens were taken on sandy bottom at the mouth of the Patuxent River, one by a beam trawl of the ship "Fish Hawk" and the other while seining over sandy shore bottoms. Four males and two females were captured by J. C. Pearson, June 25, 1931, over the muddy and oyster ladened bottoms at the mouth of the South River. E. O. Reid collected five female specimens on August 14, 1931, at Cobb Island in and near Rock Point in the Potomac River over a mixed mud-sand bottom. A 47 millimeter (1.88 inch) male was collected over a sandy bottom in Chesapeake Bay at Drum Point April 24, 1957, by H. Winn.

Known Distribution Is Rather Wide

The scaled goby has been recorded at Lewisetta and the Mouth of the Hampton River, Virginia, and young were collected within the area bounded by Cape Henry and Cape Charles on the North, Lynnhaven Roads on the South, Old Point Comfort on the West and Back River Light on the East within Virginia waters of Chesapeake Bay. Other localities along the Atlantic Coast are Uncle Israel Shoal, Pivers Island, Newport River, Cedar Creek, 12 miles offshore and in and around canals near Beaufort, North Carolina; the Charleston

(CONTINUED ON PAGE 12)

FURTHER RED SHELLFISH COLORATION STUDIES

Several Causes For Red Coloration

Commercial shellfish packers occasionally experience a red coloration in the pack of oysters **(Crassostrea virginica)** and/or soft clams **(Mya arenaria).** Usually the predisposition for color development is not evident at the time of shucking, making the problem even more serious for the packer. One known cause of red coloration is "pink yeast," which grows and develops in the pack, even under proper refrigeration. Apparently these Torulae are quite common, but can be controlled by proper plant sanitation and handling. Another type of red coloration, similar in some respects but differing in others, has been experienced by both oyster packers and soft clam packers. Under rather standardized conditions of oyster and clam packing houses, packs of shellfish during the cool and cold months sometimes develop a very definite, beet-juice or blood red coloration after three to five days storage under refrigeration.

Duration of Coloration is Variable

A few preliminary findings were reported in the September-October, 1957, edition of **Maryland Tidewater News.** Oysters exhibiting this phenomenon in the Rappahannock River developed red coloration for periods of about three or four weeks only, and oysters from these bars were normal after this period. In soft clams in the Chesapeake Bay, in the vicinity of the Bay Bridge at Annapolis, red coloration was noted the first week in October, 1957, persisted throughout the winter, finally clearing up in the spring. Soft clams in the Patuxent River, on the other hand, had only occasional brief occurrences of red coloration.

Laboratory Studies Provide Answers To Some Questions

At the Chesapeake Biological Laboratory, these problems were attacked:

1. Is color production due to the growth of living organisms in the pack after shucking?
2. Is color production due to the conversion of non-red pigments in the clams?
3. Is color production the release of a red pigment already in the clams?
4. What part, or organ, in the clam releases the red pigment?

The development of red coloration is not due to the growth of living organisms, because color developed when the clams were placed in substances inimical or inhibitory to the growth of living organisms. In some cases, color developed faster in the treated clams than in the ones that were not treated. The causative pigment is apparently entirely held in the small brown "liver" or "digestive gland," the small, brownish organ in the clam located near the hinge. This was indicated by carefully dissecting some clams and storing the various parts in separate sterile containers. Only in the containers containing the "liver" did red coloration develop. As to the question of whether the pigment is a conversion of a non-red pigment, or the simple release of red pigment from this gland, the evidence seems to indicate the red pigment is stored in this gland. When fresh glands from clams that would develop red coloration were streaked on a piece of porous paper, the red material diffused out with the liquid onto the surrounding paper and became visible. Extraction experiments further indicated this pigment is stored in the gland.

Several other pertinent facts were discovered in the course of these investigations.

1. Heating at 50° C. (122° F.) for 15 minutes modifies or destroys this pigment, while heating at 40° C. (104° F.) for 30 minutes did not alter the pigmentation. However, the meats became grayish when heated to these temperatures.
2. Soft clams held as shellstock for 10 days under refrigeration (4° C. or 39° F.) did not show noticeable red coloration when shucked, while shucked clams from the same lot developed red coloration in the pack.
3. Bacteriological tests showed no red bacteria present.
4. In some early experiments, red clam liquor from a commercial pack was inoculated into some "non-red" clams and some "non-red" oysters. Red coloration developed in the inoculated clams and oysters, while those left uninoculated did not develop red coloration. Later experiments, using freshly dug red clams, did not indicate transmissibility. These circumstances indicate pink yeast coloration may have occured along with the form of red coloration being studied.

Color Is Result of Plant Pigment

Dr. Dayton Carritt, of the Chesapeake Bay Institute, Johns Hopkins University, ran experiments to identify the red pigment. By using extraction and adsorbtion techniques with spectrophotometric analysis, he was able to characterize the red coloration as a plant pigment, probably from microscopic water plants called phytoplankton. The red pigment is probably a carotenoid from these plants.

Dr. Carritt also found that the "liver" of a clam that will turn red shows a characteristic color under ultraviolet light, while a clam that has no red coloration does not show this fluorescence.

Phytoplankton In Bay Being Studied By Fish and Wildlife Service

The U.S. Fish and Wildlife Service also investigated several aspects of the red clam problem. Mr. Phil Nelson of the Fish and Wildlife Service Laboratory at Annapolis, Maryland, made investigations of the phytoplankton in the Chesapeake Bay in the area where red coloration persisted throughout the winter. In addition, the Fish and Wildlife Service Laboratories at Milford, Connecticut, and Beaufort, North Carolina, ran experiments to culture and identify phytoplankton from this area. The results of these studies are not yet available.—D. W. LEAR.

GROWTH OF YELLOW PERCH IN TIDAL WATERS

Yellow Perch Predominantly A Freshwater Fish

Numerous studies have been and are still being conducted on yellow perch **(Perca flavescens)** in freshwater lakes and streams, but studies on its life history in tidal waters are not as common. The natural range of the yellow perch is from the Hudson Bay region southward through the Great Lakes region to South Dakota, Iowa, Illinois, and Pennsylvania, and in the

(CONTINUED ON PAGE 12)

GROWTH OF YELLOW PERCH IN TIDAL WATERS

(CONTINUED FROM PAGE 11)

Eastern States south to South Carolina. This distrubution would classify the yellow perch as a predominantly freshwater fish, thus offering one reason for the emphasis on freshwater studies. Also, it has become a pest fish in some freshwater ponds which has not been the case in tidal waters. In tidal waters, the yellow perch has developed a habit not found in the freshwater environment. It has become anadromous by returning to fresh or nearly freshwater to spawn.

Location and Harvest Known for Commercial Catch

The commercial catch of yellow perch in Maryland provides available records on locations and size of harvest in tidal waters. In addition, unlicensed short nets and the sport fishery harvest a portion of the yellow perch crop, but this amount is not known. Therefore, commercial catch does not necessarily represent total abundance of this fish. Generally, the yellow perch is found in all rivers emptying into the Maryland portion of the Chesapeake Bay and in lower salinity areas of the bay itself. A look at the 1956 commercial catch will illustrate some location where yellow perch are found (Table I).

Table I

Reported Commercial Catch of Yellow Perch in 1956

Area	Pounds	Area	Pounds
Chesapeake Bay (Howell Point north)	7114	Fishing Bay	1803
Chesapeake Bay (Bay Bridge to Howell Pt.)	17512	Nanticoke River	1715
Chesapeake Bay (Bay Bridge to Cove Pt.)	799	Patuxent River	342
Chesapeake Bay (Cove Pt. to Va. line)	0	Tangier Sound	2803
Chester River	19306	Potomac River	445
Choptank River	3638	Wicomico River (Wicomico and Somerset Co.)	412
Eastern Bay	5508		

Scales Taken From Legal Size Yellow Perch

A point of interest in age and growth of yellow perch is the age at which this fish reaches legal size (8 inches) in Maryland tidal waters. One method of obtaining this information is by means of scale analysis of legal size fish. Determination of past growth information is explained in **Tidewater News,** Volume 14, Number 1, January-February, 1958. Scale samples were available from 1016 yellow perch caught in fyke nets in the Chester River. These yellow perch ranged from 7 to 11 inches long with the majority between 8 to 9 inches in length.

Age and Growth Determined

Examination of the scales revealed some female yellow perch attained 8 inches total length in three years and all of the females in the sample had reached commercial size in four years. On the other hand, male yellow perch grew more slowly than females. A few males reached 8 inches at three years of age, but some did not attain this length until five years. Faster growth of the female yellow perch has been previously reported. Comparison of the calculated lengths at the end of each year of life revealed that the growth of this group of yellow perch from Maryland tidal waters was similar to the growth of the same species in freshwater areas, such as Lake Erie, Ohio, and Green Bay, Wisconsin. Thus, the yellow perch from the Chester River do not grow at a faster rate than the same fish in entirely freshwater environments.—R. J. MUNCY.

MD.'S OCEAN COMMERCIAL FISHERY — 1957

(CONTINUED FROM PAGE 9)

tionally the ocean fishermen return such fish to the water, as they have been considered worthless. During recent years however, a processor at Bishopville, Maryland, has begun to process industrial fish and scrap seafood for chicken feed. Several trawlers from Ocean City have started supplying industrial fish to this processor. These trawler captains contend that since the "trash" has to be handled, they would prefer to get something for their trouble. One captain maintains that this "trash" pays his fuel bill each day. From these trawlers the 1957 catch of industrial fish amounted to over 5 times that of 1956, while the 1957 value was over 12 times that of 1956.

Further Expansion of Industrial Fish Warranted

Department biologists feel that the market for industrial fish can probably be expanded greatly at Ocean City, Maryland. Possibly with a great expansion, facilities for processing would have to be located near Ocean City itself. A plant at Ocean City should result in higher prices to the fishermen since transportation costs of raw fish would be reduced. Other fishermen may consider handling this product at 80¢ or $1.00 per 100 pound box against the 50¢ a box they can now expect.—G. J. MURPHY.

THE SCALED GOBY, MICROGOBIUS THALASSINUS

(CONTINUED FROM PAGE 10)

Harbor, South Carolina; St. George Island, St. Vincent Island and Cape San Blas, Florida; the Gulf of Mexico off Calcasieu Pass in Louisiana; Aransas Pass, Harbor Island and Corpus Christi, Texas. Along the coasts of Florida, Mississippi and Texas, the scaled goby occurs with the large-mouthed goby, **Microgobius gulosus,** and the scallop goby, **Gobionellus boleosoma.** Its main center of abundance seems to be from Chesapeake Bay to Beaufort, North Carolina.

Spawning Locations Are Not Known

Much remains to be learned about the breeding habits, habitat requirements, growth rate and development of this fish. As noted above, this fish seems to prefer sandy bottom shore areas. However, the capture over oyster beds may be a hint where spawning occurs or where these fishes spend their winters. Other species of gobies utilize the oyster shell habitat during spawning and as a dwelling place. However, where the scaled goby spawns still remains a mystery as no eggs have been found under natural conditions in oyster shells or elsewhere. Females have been captured with eggs as early as May and apparently spawn through November. The heaviest catch of young is in July, August and September. Young on hatching are 4.5-9.0 millimeters (3/16-⅜") long and by September attain a length of 32 millimeters (little over one inch) long, but are not sexually mature. Fish 40-50 millimeters (1¾-2") long are mature by their second summer of life, with a few maturing as late as their third summer of life. Fish 10 millimeters (⅜") long have their pelvic fins united (Figure 1) into a sucking disk. The largest known male and female scaled gobies are 50 and 51 millimeters (2") long, respectively. Beyond this our knowledge of the biology of this fish is wanting. Anyone capturing this fish is invited to forward them and all available information to the Chesapeake Biological Labortory, Solomons, Maryland. —F. J. SCHWARTZ and W. G. MEREDITH.

MARYLAND TIDEWATER NEWS

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EDITORIAL STAFF: J. R. LONGWELL, J. H. MANNING, E. A. DUNNINGTON, G. J. MURPHY, AND R. J. MUNCY.

Volume 14 JULY—AUGUST, 1958 No. 4

INTRODUCED PLANTS AND ANIMALS MAY BECOME PESTS

Introductions Sometimes Desirable

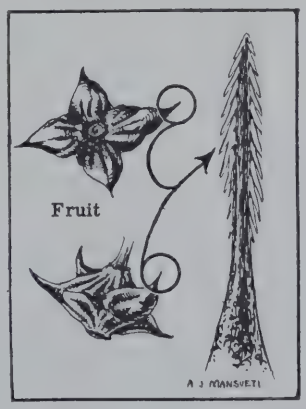
Many of our valuable domesticated plants and animals have been brought by man from foreign areas throughout the world. Such introductions produce much of our food and other useful materials. Most of them had been domesticated in other countries many generations ago so that their characteristics were well known. Over the ages man has selected those that possessed the most desirable characteristics and the least undesirable ones. Relatively few of them have recently been introduced from the wild.

Accidental Introduction Has Brought Many Pests

Few people realize that many of our common weeds were accidentally brought from other continents among the ballast of the old trading sailing vessels and as contaminants of imported grain and seed. Many insect pests similarly have been brought to this country as stowaways on ships and more recently on planes. Our quarantine inspections make special effort to keep out such pests. Some of the accidental introductions have caused tremendous losses and millions of dollars have been spent in attempts to exterminate or control them. Examples are the gypsy moth, Dutch elm tree disease, Mediterranean fruit fly, Japanese beetle, and the fire ant.

Planned Introductions May Produce Unexpected Problems

Sometimes a plant or animal may appear to possess desirable characteristics, but, once established in a new location, may multiply too freely due to lack of natural enemies, may harbor dangerous parasites, or may develop new and highly undesirable characteristics in the new environment. Introduction of rabbits to Australia, of French snails to the southwest, and of English Sparrows to the eastern United States are examples of animals thought to be desirable that soon overpopulated their new homes and crowded out other and more desirable native



Magnified View of One of the Barbed Spines of the Water Chestnut and the Seed.

(CONTINUED ON PAGE 16)

THE SIKA DEER OF JAMES ISLAND, MARYLAND

For 40 years a herd of Sika deer **(Cervus nippon)** has existed on James Island in Dorchester County. Four or five of these deer were released on this island by Mr. Clement Henry, a former owner, in 1918. The deer multiplied until a herd of at least 270 existed on the island in the fall of 1957.

Sika deer are native to Japan, China, Manchuria, Formosa and Korea. **Sika** means **deer** in the Japanese language and in that country they are kept in parks where they become tame and can be observed by visitors to the parks.

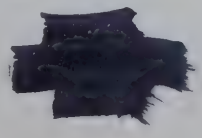
Sika Deer Differ from Native Deer

Sika deer differ considerably from our native white-tail deer. The most obvious difference is seen when the animals are running away. The tail of Sika deer is small compared to the tail of native deer but a large portion of the rump is covered by an area of white hairs surrounded by a black border. When the animal is excited these white hairs are erected showing a prominent white spot. Both sexes at all ages of these deer are spotted, the spots being especially prominent in summer. Sika deer run with a decidely jumpy or "bouncing" gait. Sika deer utter a bird-like chirp when startled and during the mating seasons the males make almost human blood-curdling screams. The antlers of the stags arise straight from the top of the head and do not curve in the manner of white-tailed deer antlers. In Japan some of the antlers are massive structures having a diameter of about two inches at

(CONTINUED ON PAGE 14)

DUPLICATE MARYLAND TIDEWATER NEWS ISSUES WANTED

Since the publication in May of the "Index to **Maryland Tidewater News**" there has been an increasing demand by institutions and libraries for complete series of the News. The first few demands have been filled after much scraping of the barrel; however, the supply of all issues is rapidly dwindling. In order to be able to fill any future demands individuals, institutions or agencies possessing duplicates or issues they no longer need are urged to return these to the Chesapeake Biological Laboratory so they may be redistributed to those institutions or libraries needing them. Early issues are the ones most seriously needed.—F. J. SCHWARTZ.



THE CUB SHARK, CARCHARINUS LEUCAS, TAKEN AT FLAG POND, CHESAPEAKE BAY, MARYLAND

Captured In Pound Net

On August 8, 1958, another cub shark, **Carcharinus leucas** (Muller and Henle), was captured in a pound net operated by the Higgins Brothers at Flag Pond in the Chesapeake Bay (salinity 10 0/00). The fish was a male specimen 8′ 3-3/8″ long weighing 290 pounds. The size of this specimen was almost identical with that of one reported from the Patuxent River at Broomes Island in 1957 (**Maryland Tidewater News** 13 (8)). The Patuxent River specimen, also a male, was slightly shorter and narrower than the Flag Pond specimen.

Maximum Length of this Species is 10 Feet

Examination of the 1958 specimen's stomach revealed it had considerable amounts of sand and gravel in it. No fish or fish remains were found in the digestive tract even though it had struck twice at a cownose ray, **Rhinoptera bonasus,** and had cut other captured fish within the pound net. A single blow on the head with a hammer subdued the fish which, except for the attacks on the cownose ray, was quite docile.

Bigelow and Schroeder state that **C. leucas** matures at a length of seven feet while 8-8½ foot fish weigh 250-375 pounds, with some fish reaching 10 feet in length. The gonads of the Flag Pond specimen were found to be flaccid, with no signs of milt present therein.

Teeth Aid In Identification

Of the Carcharinid sharks, 13 species of the genus **Carcharinus** are found in the western Atlantic. **C. leucas** can be easily separated from other Carcharinid sharks, except for the Lake Nicaragua shark, **C. nicaraguensis,** the white tipped **shark, Pterolamniops longimanus,** and the lemon shark, **Negaprion brevirostris,** by its short broad rounded back, serrated teeth on both upper and lower jaws, and a small second dorsal fin. Similar appearing **N. brevirostris** has smooth teeth while **P. longimanus** has serrations on the cusps of the upper and lower teeth. **C. nicaraguensis** appears to be a restricted freshwater derivative of **C. leucas** which is found in Lake Nicaragua, and also possibly the San Juan River, Nicaragua, and is distinguishable by longer gill openings and a greater first dorsal height to dorsal base ratio than in **leucas.**

(CONTINUED ON PAGE 16)

THE SIKA DEER OF JAMES ISLAND, MARYLAND

(CONTINUED FROM PAGE 13)

the base. The Maryland stock, however, has much smaller antlers, the largest seen so far was 10 inches long with an antler base diameter of three-quarters of an inch.

If in doubt concerning the identity of a dead animal identification can be made by examining the interior of the mouth. On the upper jaw of the Sika deer about an inch ahead of the grinding teeth (on each side) is a small tusk or canine tooth. These teeth are absent in white-tailed deer.

The James Island Sika deer weigh considerably less than do white-tail deer. Adults weigh between 40 and 60 pounds compared to white-tail adults of this area which weigh between 110 and 150 pounds.

Sika Deer Increasing and Spreading

The James Island deer frequently swim to nearby Taylors Island to feed and then return to their own island. However, some individuals must have found Taylors Island more to their liking and remained there to multiply and produce another herd. These deer have now spread to the mainland of Dorchester County and are continuing to spread out over the county. A few of these animals are shot each year during the hunting season. It should be emphasized here that James Island and the deer herd are privately owned and, consequently, trespassing is discouraged.

161 Deer Perish in 1958 Catastrophe

Sika deer had become so numerous, in recent years, on James Island that when the winter of 1957-58 arrived there were more deer on the island than could be sustained by the available food. As stated above, a minimum of 270 animals existed on the island in the fall of 1957. In August 1957 a fire destroyed a large portion of the vegetation on the northern portion of the island. The loss of this food coupled with the unusually severe weather in February and March of 1958 subjected the deer to severe hardship. Ice which formed around James Island discouraged the deer from crossing to Taylors Island to feed. Bodies of 161 deer which had presumably died from malnutrition were found on James Island in February, March and April of 1958. In May 1958 a count of the deer revealed that 109 live deer remained on the island. According to these figures almost two-thirds of the total herd perished in this catastrophe.

Sika Deer May Become A Serious Pest

A number of people have expressed sympathy concerning the Sika deer catastrophe. They would like to see the deer saved from repetitions of this mortality. Efforts are now being made to prevent a recurrence of this tragedy. There is, however, a very serious factor to be considered when dealing with exotic species. In many cases, especially with respect to mammals, the introduced species becomes a nuisance sometimes with very serious consequences. The introduced species becomes too abundant often at the expense of related species. The Sika deer has demonstrated its ability to survive and multiply on James Island under conditions that would not support white-tail deer and therefore could cause serious losses to forestry and agriculture. On the other hand this species may become a supplementary big game animal which can supply much additional recreation to our growing number of hunters.

Cooperative Studies of Sika Deer Now Underway

Since the tragic episode of last winter the Game and Inland Fish Commission and the Department of Research and Education with the help and cooperation of the University of Georgia, School of Veterinary Medicine, have been studying these deer. Other countries such as Great Britain, France, Denmark and New Zealand have had experience with introduced herds of these deer. Will the Sika deer become a desirable addition to our fauna or a nuisance? It is hoped that our studies in addition to information obtained from other countries can help us to understand these strange deer.
—V. F. FLYGER and J. R. BOWERS.

DEEP CREEK LAKE INVESTIGATIONS CONTINUE

Management Program is Promising

As the five-year management program for Deep Creek Lake, Garrett County, Maryland, passes the half-way mark, biologists are very optimistic about its chances for success. During a shore-line rotenoning and electrofishing project conducted jointly by the Game and Inland Fish Commission and the Department of Research and Education in July, 1958, great numbers of young-of-theyear chain pickerel were found. This discovery indicates that suitable pickerel-spawning habitat exists in the lake, a point about which there had been considerable doubt.

Four Predator Species Introduced

The five-year program for Deep Creek Lake consists largely of "corrective" stocking, that is, the introduction of predator fish to control the overabundant yellow perch. Four species have been planted: chain pickerel, northern pike, walleyes and striped bass. Of these, only the chain pickerel are definitely known to have spawned in the lake. A single small northern pike taken during the survey indicates that the eggs of northerns can hatch and the young survive. Adult northerns were planted early in March, 1958, and 800,000 eggs were stocked in April. The six-inch specimen that was taken was either from the spawn of the adults or from the planted eggs.

Single Species Sufficient As Predator

No evidence of walleye or striped bass reproduction was found. However, this fact does not dim the biologists' optimism because it is felt that any one of the predator species, if it could build up a large population, might control the yellow perch. Although three other predator species, largemouth bass, smallmouth bass and redfin pickerel, existed in the lake before the management program began, they were unable to keep the perch in check. It has been suggested that the two species of bass were, instead, being kept in check by the perch. Yellow perch spawned about six weeks ahead of the bass so they were able to prey on the bass as soon as the bass eggs hatched. The redfin pickerel, although an excellent predator, is so small (rarely over 12 inches) that it is ineffective as a predator of larger perch.

Pickerel Eat Perch

The stomach contents of a few chain pickerel were examined and it was found that the bulk of the food present was yellow perch. This indicates that the pickerel are working at the job they were supposed to do. One of the pickerel had eaten a smaller pickerel. This evidence should help allay the fears of those who worry that pickerel might overrun the lake. The fact that pickerel will readily eat their own kind indicates they may tend to keep their own population in check.

Fishing Has Apparently Improved

One further note of good news is the fact that fishing seems to be much better in 1958 than in any year since the lake has been under study. Accurate data are not yet available, but many reports have been received of large catches of fish and of catches of large fish. It is expected that this favorable trend will continue.—H. J. ELSER.

LOW SALINITY AND UNUSUAL BIOLOGICAL CONDITIONS NOTED IN CHINCOTEAGUE BAY

Topography, Rainfall and Evaporation Control Salinity

The saltiness or "salinity" of water usually is expressed as parts of salt per thousand parts of water. Offshore waters of the open ocean contain about thirty-five parts per thousand and remain relatively constant. Estuaries such as Chincoteague Bay may vary considerably according to their nature and according to the time of year, but show a characteristic pattern for each particular body of water. During the past three months the salinity of Chincoteague Bay waters has been about five to eight parts per thousand below its usual value of twenty-five to twenty-eight for the early summer season, and has dropped as low as nineteen. These salinities are the lowest on record for the seven year period during which continuous observations have been made by the Department of Research and Education. They are the result of abundant local rainfall and of unusually cool temperatures that have slowed evaporation during the past few months.

Algal Growth and Oyster Loss Reported

An abundant growth of red algae appeared during the early part of this summer throughout the bay area. The algae (sometimes referred to as "moss") became so thick that it matted crab pots and float lines so that the floats sank, causing losses to local crabbers. Many of these pots were found later after the algae died and the floats returned to the surface. During June certain locally heavy oyster mortalities also occurred. On the eastern side of the bay, in an area where the growth of algae was greatest, about 11,000 bushels of oysters died. Oyster mortalities associated with dense mats of algae have been observed in other years. Since there has been no evidence of other unusual conditions at the time of the oyster deaths, the possibility of a relationship with the observed low salinities and algae blooms is suggested.

Small Changes May Have Far Reaching Effects

The delicate balance that exists among the physical and biological components of a complex environment, such as Chincoteague Bay, may sometimes be drastically upset by a slight change in a single factor. Far more research is needed before all of the interrelationships can be understood and explained. Nevertheless, while by no means clearly demonstrated, there is some suggestion that the following chain of events may link the occurrences in Chincoteague Bay this summer. Increased runoff brings increased nutrients to the Bay. The increased nutrients, and the possible effect of low

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INTRODUCED PLANTS AND ANIMALS MAY BECOME PESTS

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species. Release of western rabbits in the eastern United States brought tularemia and Rock Mountain spotted fever. The English starling lost its normal migratory habits when introduced to this country and here congregates in huge flocks in cities, creating a nuisance problem that is unknown in its native home.

Our Water Resources Can Be Damaged By Undesirable Introductions

Though few people think of the possible danger to aquatic or marine resources through introduction of foreign species, instances of such damage already are present. The European carp, introduced as a useful food fish, has crowded out more desirable native fish, has uprooted aquatic vegetation and has churned up bottom sediments in reservoirs and lakes. The water chestnut, introduced as an ornamental for ponds, required the expenditure of several hundred thousand dollars for removing it from the Potomac River and is still out of control and clogging channels in the Gunpowder River and in areas of New York and Massachusetts. The European oyster in England has suffered great destruction by American oyster drills and slipper limpets that were accidentally introduced in plantings of American oysters.

The Oyster Particulary Vulnerable

The most valuable water crop of Maryland is our native oyster. Laws have been enacted to protect it from some foreign introductions that are known threats. One of these is the Japanese or Pacific oyster that is a more prolific and rapid grower and is believed capable of crowding out the native species. Since our native oyster is preferred by local consumers and has an established and higher market value, its loss in exchange for the new species would be a damaging blow. Furthermore several serious oyster enemies have been brought with seed oyster to our Pacific Coast from Japan, including Japanese oyster drills. These could easily be introduced with disastrous consequences if plantings of Pacific oysters were permitted in our waters. Our present laws prohibit the planting of any foreign species of oysters in Maryland and also prohibit the transplanting of native oysters that contain oyster drills or their eggs.

Thoughtless Introductions Must Be Guarded Against

It is recognized that new species after having been found to offer no threats to the native ones, can sometimes be introduced with resultant advantages. However, such introductions should be made only by authorized agencies who have made careful studies of the possible effects of the introduction. Laws cannot solve all such problems. They do not specifically forbid the introduction of many plants and animals that could be brought in. While most known parasites of our native oyster can spread naturally along its range as far as water conditions will permit, there is at least one isolated area in eastern Canada where a disease not known elsewhere has destroyed huge quantities of oysters. These oysters are cut off from those further south by great barriers of water along the Canadian and Maine Coasts that remain too cold for oyster reproduction. Nevertheless, the careless placing of live Canadian oysters in American waters might easily introduce a crippling oyster disease and still violate no present laws. Many of our people are ignorant of both the laws that forbid certain introductions, and of the great damage that sometimes results from the careless bringing in of plants and animals that are foreign to our local populations. We should continue our search for new species that can be of great value without causing harm, but we must release them only after careful study, and so avoid the mistakes of careless and hasty introduction.—G. F. BEAVEN.

LOW SALINITY AND UNUSUAL BIOLOGICAL CONDITIONS NOTED IN CHINCOTEAGUE BAY

(CONTINUED FROM PAGE 15)

salinity in reduction of controlling agents, may have stimulated the excessive growth of algae that occurred. Drifting algae can produce thick mats over certain areas of the bottom. When these mats of algae decompose they consume oxygen and may reduce the available supply to zero near the bottom. This condition was observed under an algal mat in Chincoteague Bay a number of years ago. Lack of oxygen permits the growth of sulphur bacteria that release hydrogen sulphide from organic material at the bottom. This hydrogen sulphide is highly toxic and capable of killing oysters. Such a chain of events, and many others of similar nature but with less conspicuous results, may have occurred in the bay this summer. An analysis of past conditions for deviations from normal often may help us find such relationships. The present accumulation of records of conditions in the bay is of increasing value in making this possible. Many more descriptive and experimental studies are needed, however, before complete and positive answers can be given to such problems as red algae growth and oyster mortalities.—F. W. SIELING.

THE CUB SHARK, Carcharinus leucas, TAKEN AT FLAG POND, CHESAPEAKE BAY, MARYLAND

(CONTINUED FROM PAGE 14)

This Species Occurs Commonly Northward To South Carolina

The center of abundance of **C. leucas** seems to be the West Indies-Caribbean region, including the Gulf of Mexico, French Guiana, Cuba, Puerto Rico, Bahamas, Panama Canal and Guatemala. Common occurrence records exist as far northward as South Carolina, with occasional records noted for North Carolina, New Jersey, and New York. **C. leucas** appears to be most abundant around Florida during the winter, the Gulf of Mexico along the Texas coast near Galveston in the summer, and occasionally in freshwater in Louisiana.

Apparently, as with other tropical fishes, the recent Maryland records hint of a tropical species expanding its range northward during the warmer summer months and as a result of increasing oceanic water temperatures. Whether this is the true picture remains to be seen.

Many thanks are extended the Higgins Brothers of Flag Pond for making the latest **C. leucas** available for measurement and study.—F. J. SCHWARTZ.

MARYLAND TIDEWATER NEWS

Entered as Second Class Matter at Solomons, Maryland. Office at Chesapeake Biological Laboratory, Solomons, to which all communications should be addressed.
EDITORIAL STAFF: J. R. LONGWELL, J. H. MANNING, E. A. DUNNINGTON, G. J. MURPHY, AND R. J. MUNCY.

Volume 14 SEPTEMBER — OCTOBER No. 5

DEEP WATER OYSTER LOSSES IN CHESAPEAKE BAY

Summer Mortality of Oysters Confirmed

This fall, oystermen from a number of areas in Maryland have reported finding most of the oysters dead on the deeper portions of certain bars. At the same time oysters on the shallower parts of the bars are reported to be thriving and in good condition. Fortunately, most Maryland oysters are caught in water less than twenty feet in depth, and a number of the deeper bars occur where strong currents prevent the stagnation of bottom water that may cause oyster deaths. The unusually large extent of water areas that were "stagnant," or lacking in oxygen during the past summer, was most evident in August at the time that many crabs were found dead in crab pots and dead fish observed at several points along the bay shore. The fact that oysters in deep water might also be expected to show an unusually high death rate was pointed out following these August observations.

Natural Conditions Caused Loss

Scientists at the Laboratory about twenty years ago first noted that large masses of deep water without oxygen occur in many mid-Chesapeake areas during the summer months. Through continuing research, the causes of this condition are now known. The oxygen dissolved in water comes mostly from the air at the water's surface. Wave action and currents tend to mix surface water with the layers of deeper water so that for much of the year sufficient oxygen for fish, oysters, crabs and other animals is found even in the deepest part of the bay. During the summer, however, the surface water becomes considerably warmer than bottom water and this makes it lighter in weight so that it tends to remain floating at the surface. Also fresh water from rain and streams is lighter than salt water and tends to float above it. The result is that a two layered system is formed with warm, fresher water near the surface and cool, saltier water near the bottom. The division between the layers may be quite distinct with very little mixing. Decomposition of animal and plant remains and respiration by animals and plants soon consume the dissolved oxygen present near the bottom, and inability to mix with surface water cuts off a renewed supply. The result during most summers is that the dissolved oxygen becomes exhausted at depths of about forty feet or more in certain portions of the bay and tributaries. This limits the depth at which oysters can grow and in which oysters or crabs can remain at the season. Winds can cause unusual and exceptional local conditions.

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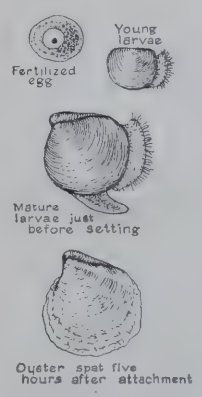
POOR 1958 OYSTER SETS INDICATED

Final Counts To Be Made Later

A complete picture of 1958 oyster setting in Maryland must await the end of the setting season and completion of counts throughout the state. There are early indications, however, that the Maryland set this year may be poor in many areas. Up to late September there had been little or no setting in most of the Patuxent River, the adjacent Chesapeake, the St. Marys River, and upper Fishing Bay. Preliminary reports indicate a similar condition in the Eastern Bay area. A below average set has been observed in Smith Creek, Honga River, Tar Bay and the Manokin River area. The best set thus far observed was at Holland Straits, where a good but not exceptionally heavy set is indicated. The above statements are based upon test shell findings compared with similar observations during previous years. The final picture may be altered by poor survival of the spat observed, or by unexpectedly late setting which is possible up until about mid-October.

Use of Test Shells

Each season biologists of the Laboratory at Solomons learn the time and amount of oyster setting in certain areas by examining "test shells." These are clean shells placed in chicken wire bags and put overboard for one week periods throughout the setting season. When removed from the water after one week's exposure the number of "spat" attached to twenty shell faces is counted under a low power microscope. The spat, or baby oysters, are too small at first to be seen by the naked eye and are little more than the size of a pin head when two weeks old. Counts obtained from test shells are higher than those of large spat counted on regular shell plantings during late fall or winter. This is because the test shells do not have time to become covered with silt and fouling organisms that interfere with setting. Also many of the tiny spat counted would later be smothered or killed by predators if the shells remain overboard until the spat have grown larger. Nevertheless, the counts furnish a good comparison of setting from year to year, and are useful in determining the most favorable time for making shell plantings that will not become badly fouled before the oyster set occurs.



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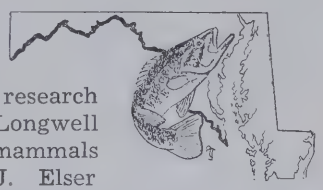
INLAND RESOURCES DIVISION TRANSFERS TO ANNAPOLIS

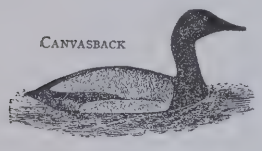
All of the research in the Department of Research and Education concerned directly with game, forestry, fresh water fish, wildfowl and similar resources has been moved into the new State Office Building at Annapolis. This transfer will permit more effective cooperation with the Department of Forests and Parks and the Department of Game and Inland Fish than had previous arrangements which utilized Solomons, Maryland, as headquarters.



Dr. Vagn F. Flyger is Chief of the Inland Resources Division and engages in a variety of biological research problems. Mr. John R. Longwell conducts studies on game mammals and birds, Mr. Harold J. Elser investigates fresh water fishery problems and Mr. Craig D. Whitesell is the research forester. Mr. James R. Bowers is employed by the Department of Game and Inland Fish but assigned to this Division for intensive investigations of white-tail deer throughout Maryland.

The Conservation Education Division of the Department, conducted by Mr. Byron L. Ashbaugh, is also now located in these quarters.

Dr. L. Eugene Cronin, Director of the Department, maintains an office in the Annapolis State Office Building as well as one at the Chesapeake Biological Laboratory at Solomons. Solomons will continue to function as headquarters for all of the estuarine and marine research on the resources of the bay and its tributaries.


CANVASBACK

Correspondents who wish to reach the Inland Resources Division and the Conservation Education are particularly requested to make note of these changes.- L. E. CRONIN.

CUB SHARK, CARCHARINUS LEUCAS, FROM BIG ANNEMESSEX RIVER TANGIER SOUND MARYLAND

Recently a third cub shark, **Carcharinus leucas,** was brought to this laboratory's attention through the thoughtful efforts of fishermen in Crisfield, Maryland. On July 28, 1958, an 8′ 3″, 248 pound cub shark was caught in a haul seine at the mouth of the Big Annemessex River by Clayton Howard. The crew of the Franklin E., along with Mr. Howard, consisted of F. Esley, O. Linton and A. Culbertson. Clouds of mud and sand were stirred up during the hour-long battle which took place before the shark could be gaffed and brought ashore. The shark is not known to have directly made any attack on the crew; however, it thrashed violently in the pocket of the seine in its efforts to escape. Hardheads (25 pounds) and spot (17 pounds) were the only other fish taken in the catch.

After exhibition, the shark was frozen and stored in the local ice house at Crisfield until it could be examined and the Chesapeake Biological Laboratory was notified. It is hoped that future catches of any "odd" fish may be handled in the same fashion. A little

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FALL WEATHER BRINGS FATTER OYSTERS

How Oysters Feed

In order to understand why oysters fatten one must know how they feed. Oysters gather tiny microscopic plants from the water along with tiny animals, and some plant and animal debris. They do this by straining the water through their gills and entangling the food particles in a sort of mucus net. A large oyster has been known at times to pump at a rate of nearly fifty quarts per hour but this is exceptional and the usual rate seldom exceeds eight to twelve quarts an hour. Pumping and feeding may occur for more than twenty hours a day in warm weather but slows down as the water becomes colder. Little or no feeding is done at temperatures of about 40° F. or lower. Clumps of entangled food particles are passed across a set of "lips" where sand and other undesirable debris may be rejected and the retained food then enters the oyster's mouth near the hinge.

Certain Sites More Favorable

Most oysters grow best in estuaries where fresh and salt water mix. While the oyster is a salt water animal it finds food more abundant where nutrients brought down by streams will cause an abundant growth of the tiny plants needed. Also fewer of its enemies occur in the fresher water. A disadvantage of estuaries, from the oyster standpoint, is the fact that streams of fresh water also may bring in mud or silt that clogs up the feeding mechanism of an oyster so that most of the material strained out will be rejected. Also muddy water shuts off the sunlight that is needed for the tiny water plants to flourish. Oysters thus feed best in clear water. It even has been found that an overabundance of the very things that an oyster eats can interfere with the straining process and starve the oyster. Furthermore, currents must be present that will bring the food to the oyster and the bottom must be firm enough to hold the oyster up where water can flow over it. Thus certain places are more favorable for good growth than others.

Frosty Nights Mean Fatter Oysters

It is an old saying among watermen that a few frosty nights are needed to make the water clear and the oysters fat. No truer observation could be made. The reason for it, however, is somewhat complex. In summer deep water near the bottom is unstirred by waves and constantly accumulates the remains of plants and animals that sink into it. Bacteria break these down and make the bottom much richer in nutrient salts than at the surface. The frosty nights of fall make the surface water cooler and heavier than at the bottom. The cold and muddier surface water then begins to sink while the clear and nutrient-rich bottom water rises and spreads out over the oyster bars and shallows where sunlight permits rich growths of tiny plants that use the renewed supply of nutrients. Here then is abundant food in clear water where oysters can now feed at their best. This process of the water turning over continues all during the fall so that, if other conditions are favorable, the oysters will get fatter and fatter until cold weather in December greatly slows down their rate of feeding. The cooling water in fall also stops oyster spawning so that more food can be stored in the oyster's

(CONTINUED ON PAGE 19)

PROGRESS REPORT ON THE SUSQUEHANNA FISHERY STUDY

The preliminary phase of the 3-year study is well under way, according to Dr. L. Eugene Cronin, chairman of the Committee and Director of the Maryland Department of Research and Education at the Chesapeake Biological Laboratory, Solomons, Maryland. The research project is headed by Dr. Richard Whitney, a biologist with experience in fishery research in Iowa and California, who was appointed by the Advisory Committee a year ago. He is assisted by Mr. Daniel S. Plosila, fishery biologist from Michigan, Mr. Harry Jobes, fish culturist assistant from Maryland, and Mr. Frederick Meyer, a Cornell University undergraduate in fisheries. The work has been centered at the newly set-up headquarters on the river at Havre de Grace, Maryland.

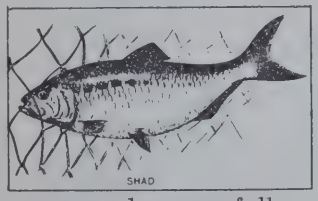
The project is administered by the Maryland Department of Research and Education, although the technical aspects must be approved by the Advisory Committee. In addition to Mr. Stanley Moyer, of the Philadelphia Electric Company, and Dr. Cronin, the Committee consists of several distinguished fishery scientists: Dr. W. E. Ricker, Fisheries Research Board of Canada; Dr. Daniel Merriman, Director, Bingham Oceanographic Laboratory; and Dr. A. S. Hazzard, Assistant Executive Director, Pennsylvania Fish Commission.

Project Designed To Aid Decision For Or Against Fishway

Scientific research has been devoted to answering some of the important questions posed by the construction of a series of hydro-electric dams along the lower Susquehanna River in Maryland and Pennsylvania during the last several decades. The project is designed to provide a sound biological basis for decision as to whether or not passage should be provided for migratory fish at Conowingo Dam which is located near the confluence of the river and Chesapeake Bay in Maryland. Specific investigations under way will help in the determination of the kinds and numbers of fish which now reach the lower side of Conowingo Dam and the estimation of the effects of the passage of these fish. Secondary but important questions on the biology of the various species and the effects of dam operation on young and adult fish are gradually being answered.

Biologists Discover Shad Pass Safely Through Turbines Of Conowingo Dam

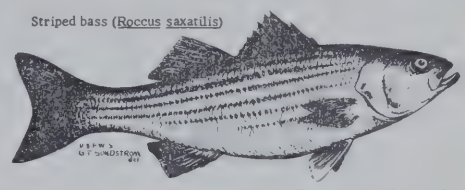
Shad planted in Conowingo Reservoir were able to pass successfully out of the impoundment through the turbines of the dam and live. A total of 2,983 shad were tagged, of which 2,086 were planted above the Conowingo Dam last spring to determine whether they would survive, spawn and successfully negotiate the dam on their downstream migration. Tags received by biologists from fishermen who caught the fish below the dam amounted to 6 per cent of the shad planted above. The 83 fish that passed through the turbines confirm earlier evidence that fish would live. The spillway gates were not open between the dates of tagging and recapture. Two of the tagged shad were reported caught at Cape Charles, Virginia, one 8 days and the other 28 days after being released. Another was taken in the Potomac River 15 days after tagging. Recaptures of most of the tagged fish, however, were concentrated in the area of Chesapeake Bay between Baltimore and the Susquehanna River. An angler caught one of the shad above the dam.


SHAD

Balloons and shad seem unrelated, and yet some interesting information was obtained by attaching balloons to the fish with long nylon lines in an attempt to follow the movements of these fish after their release. The shadow of the railroad bridge across the mouth of Conowingo Creek apparently appeared to act as somewhat of a barrier to the shad tagged with balloons.

Many Factors Being Studied at the Dam

About 2000 striped bass from the Rock Hall area have been tagged and stocked above the dam and 500 below Havre de Grace. These are in addition to the 3,947 "rock" introduced by the Maryland Game and Inland Fish Commission in 1957.


Striped bass (Roccus saxatilis)

To understand the reservoirs of the river, important observations have already been made on the chemical and physical aspects of the water in Conowingo Reservoir. These included temperature, oxygen and other environmental conditions. Such information may prove useful to studies conducted in other dams on the Atlantic Coast. Nets that were set in the Reservoir yielded information on other fishes that might compete with any introduced migratory fish.

A creel census in spring 1958, similar to the canvass of fish caught by anglers made in 1955 and 1957, indicated a heavy fishing pressure. The primary objective of this part of the study is to secure estimates of total fishing pressure, catch composition by size and kinds of fish, and the catch per amount of effort expended. Results of this survey will be publicized as soon as available.

FALL WEATHER BRINGS FATTER OYSTERS

(CONTINUED FROM PAGE 18)

body rather than used up in spawning. Thus clearer water and fatter oysters are a natural result of frosty fall weather.

Top Condition This Fall

Cool fall weather came early this year so that clear water has been in evidence for some time. Oystermen and packers in most areas of Maryland are reporting that oysters are in exceptionally fine condition for so early in the season. Not only does this mean a yield of more pints of oysters from each bushel shucked, but the consumers will find each oyster plump and tasty so that demand for the succulent bivalves is expected to be high this season. - G. F. BEAVEN.

CUB SHARK,Carcharinus Leucas, **FROM BIG ANNEMESSEX RIVER, MARYLAND**

(CONTINUED FROM PAGE 18)

thought has made another bit of valuable information available about this species of fish. This fish, although weighing less than the two reported earlier (Maryland Tidewater News 1957, 13(8); 1958, 14(4) would have been of little scientific value had these efforts not been taken. - F. J. SCHWARTZ.

DEEP WATER OYSTER LOSSES IN CHESAPEAKE BAY

(CONTINUED FROM PAGE 17)

Severe Depletion in the Summer of 1958

During the past summer an unusually extensive oxygen deficiency or stagnation was found in the Chesapeake. It extended over a wide area from the mouth of the Rappahannock River north to the waters near Kent Island. The mouth of the bay and the head of the bay, for reasons which are known but are somewhat complex, did not show severe depletion. Many locations in the bay and in the mouth of the Potomac River were totally lacking of oxygen in all waters more than twenty feet below the surface. Observations by the Chesapeake Bay Institute, the Virginia Fisheries Laboratory and the Chesapeake Biological Laboratory indicate that the past season produced the most extensive low oxygen mass in the Chesapeake Bay during the last ten years of careful study.

Because of the enormous area involved, it is not possible to know how long any one group of oysters was exposed to this dangerous condition. It is probable that all oysters in the Potomac River and the middle of the bay, in water deeper than twenty feet, were in danger and that some of them were killed.

Unusual 1958 Conditions

The combination of heavy rainfall and lack of strong winds during this summer contributed much to this condition. The heavy rains during the spring and summer brought unusually large quantities of nutrient salts and of plant and animal debris into the bay. The nutrient salts stimulated extensive blooms of tiny plants that discolor the water and added their material to the bottom layers as they died and settled. A type of bacteria, that grows when oxygen is lacking, flourished upon the plant and animal debris at the bottom and released into the water a poisonous gas known as hydrogen sulphide that smells like rotten eggs. Samples of deep water in the affected areas smelled strongly of this gas. It may have been the direct cause of many of the deaths of fish, crabs and oysters, but its presence was due to the chain of natural occurrences described. In some cases this year winds caused the lethal water to be pushed unusually far over more shallow areas for, in at least one instance, crabs were reported to have been killed in pots set at twelve feet along both the Eastern Shore and the Western Shore.

Damage Has Been Limited

Fortunately most fish and crabs are able to move out of the affected water so that crabs confined in pots were the chief sufferers. Dead fish were not abundant and were mostly bottom dwellers such as hog chokers and toad fish. Probably less than five per cent of our oysters grow in the deeper water so that losses among them were limited and chiefly of local concern. Nevertheless, this represents an additional drain upon our already too low resrve supply of oysters. Little can be done by man to prevent losses of this kind except through such measures as removing crab pots from deep water at times of oxygen deficiency, and concentration of oyster cultural practices upon bottoms that are unaffected. In many areas of the world far more disastrous natural kills have occurred than have thus far been seen in the Chesapeake. - G. F. BEAVEN.

POOR 1958 OYSTER SETS INDICATED

(CONTINUED FROM PAGE 17)

Many Conditions Affect Set

A number of factors may cause great variations from year to year in oyster spawning, the survival of oyster larvae, and the attachment of spat. Among these are: abundance of brood stock, salinity of the water, temperature conditions, food for larvae, scattering of larvae by tides and currents, chemical conditions, cleanliness of "cultch" or shells, presence of diseases that affect larvae and spat, abundance of enemies that feed upon larvae and spat, silt deposits on shells, smothering by fouling growths, and many others. A favorable combination of all these factors seldom occurs. Few of them can be changed by man except the abundance of brood stock and the presence of clean shell as cultch in places where oyster larvae tend to concentrate naturally. By providing these two, however, the average amount of set can be increased under most conditions.

Unfavorable Factors This Season

At least three unfavorable factors are apparent this year:

1. Adult oysters or brood stock are too thinly scattered in many areas for most effective spawning. The spawn of one sex in the water will stimulate spawning by the opposite sex. Oysters close together in beds tend to spawn completely while widely scattered oysters may spawn very little. High prices for oysters have caused increased catching efforts that have taken a higher proportion of the oysters from the beds during recent years.

2. Extensive areas of bottom water have been deficient in oxygen. This not only has killed some oysters in deep water and affected the amount of spawning, but has offered a great hazard to the survival of oyster larvae during the two weeks that they drift with the tide before setting.

3. Exceptionally low salinity has existed this spring and summer throughout the Chesapeake area. It always has been noted that setting is more abundant towards the lower bay and that setting generally is better in the saltier areas if other conditions are favorable. Recent and important research upon the survival and growth of clam and oyster larvae at different salinities has been conducted at the Milford, Connecticut, laboratory by Mr. H. C. Davis of the U. S. Fish and Wildlife Service. This demonstrated effectively that even oysters which live in low salinity water (Hodges Bar) required a salinity of between 10 and 15 parts per thousand for best development of their eggs. Oysters grown in more salty water needed a higher salinity. Over most of the Maryland portion of the Chesapeake, salinities during the past spring and early summer were generally below the above figure and it is probable that this may have been the principal reason for the poor setting that occurred over most areas. It seems significant that the setting thus far observed has occurred in the higher salinities represented. - G. F. BEAVEN

MARYLAND TIDEWATER NEWS

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EDITORIAL STAFF: J. R. LONGWELL, J. H. MANNING, E. A. DUNNINGTON, G. J. MURPHY, AND R. J. MUNCY.

Volume 14 NOVEMBER — DECEMBER, 1958 No. 6

MOVEMENTS OF YELLOW PERCH FOLLOWING SPAWNING IN SEVERN RIVER, MARYLAND

The Separation of Various Populations of Fish

Defining the boundaries of fish populations within various river systems is a necessary step to the understanding of their biology and management. Such information helps to explain the reasons for the changes in abundance within the different rivers, the contribution of spawning population in one river system to populations in other areas, and the length of time that these fish will be available for fishing in those areas. Several methods have been used in previous studies on fish to determine if fish from various areas were distinct groups instead of one large group. Comparisons of the number of scales and fin rays of fish from different areas have aided in separating populations. Another method of separating fish populations consists of identifying structures on the scales or differences in growth of fish from various areas. A more direct and often used method is that of tagging fish and following their subsequent movements by the locations from which tags are returned later.

Severn River Yellow Perch Tagged During Spawning Run

In conjunction with a trapping operation at the head of the Severn River, all yellow perch captured were marked either by tagging or fin clipping and returned to the water. A total of 1281 yellow perch with approximately equal numbers of both sexes, was tagged during the 1958 spawning run. Some of the male yellow perch were recaptured as many as three times during the spawning period. Recaptures of tagged female yellow perch on the spawning grounds were

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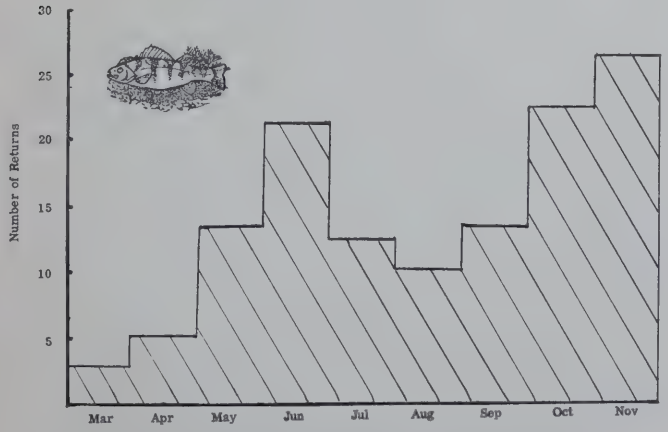
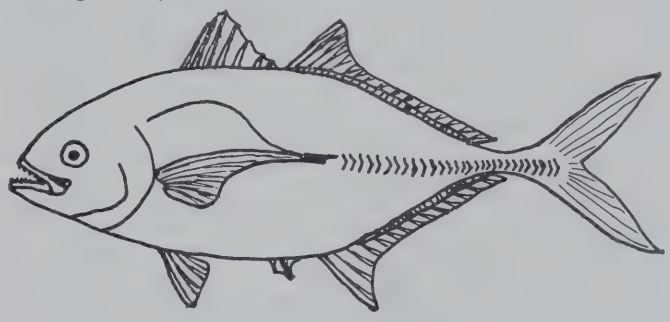


Figure 1. Plot of Yellow Perch Tag Returns from March through November, 1958, Severn River, Maryland.

NOVEMBER CAPTURE OF THE BLUE RUNNER, CARANX CRYSOS (MITCHILL), IN CHESAPEAKE BAY

Unexpected Late Capture

Four specimens of the blue runner, **Caranx crysos** (Mitchill), ranging in size from 5-3/8 to 6 inches were unexpectedly obtained November 25, 1958, from the



Caranx crysos (Mitchill)

150-foot-deep water hole near Buoy 16 D and Barren Island, in Chesapeake Bay. A test explosion in this area produced these four fish along with three silver perch, **Bairdiella chrysura,** 200 menhaden, **Brevoortia tyrannus,** and nine 14-16 inch striped bass, **Roccus saxatilis.**

Fish Is Known By Many Names

The blue runner is known by many names: hardtailed jack, hardtail, yellow mackerel, corinera, crevalle, carangue grasse, jagu, bau, deep-water cavaly and rudder fish. Locally it is known as the "Jenny Lind" or pompano. The blue runner is a summer transient species in Chesapeake Bay and offshore ocean waters of Maryland. It often appears by late July or August in pound nets as far up the bay as Long Beach, Maryland. This year, for example, a number of these fish were taken at Flag Pond as early as August 15, 1958. Most Chesapeake Bay specimens are not much over 6 inches long and a few ounces in weight, though they do reach a size of 3-4 pounds and 20 inches length.

Species Often Confused With Other Related Fish

The blue runner is often mistaken for the pompano by local fisherman. The blue runner and pompano belong to the same family of fishes known as Carangidae and are closely related to the true mackerels, Scombridae. The Carangidae can be easily distinguished from the Scombridae. Unlike the Scombridae, which possess small extra dorsal and anal finlets, the Carangidae do not have these features. Carangid anal fins usually possess two free anal spines which may be lost with age. The mackerels usually have two small keels (lack-

(CONTINUED ON PAGE 24)

STRIPED BASS TAGGED BY SOLOMONS LABORATORY REMAIN LARGELY IN BAY

Over One-third of All Tagged Fish Recaptured

Tagging studies on striped bass during 1957 and 1958 demonstrated that the bulk of recaptured fish remained in the Maryland part of Chesapeake Bay. Of 1088 fish tagged and released in Maryland waters by biologists of the Chesapeake Biological Laboratory, 410 fish (almost 38 percent) were recaptured. Only three of the recaptured striped bass ventured out of Chesapeake Bay, but the locations where they were retaken are of great interest.

(1) **Massachusetts**-Tagged April 26, 1957, on the spawning grounds in the Elk River, near the mouth of the Chesapeake and Delaware Canal, this fish was recaptured by an angler in the Weweantic River, near Wareham, Plymouth County, on June 13, 1958. When tagged with a nylon streamer tag, it weighed 6 pounds, 8 ounces, but when recaptured, the angler reported that it weighed 7 pounds, 14 ounces. This fish, the sex of which was unknown, was free for 444 days and travelled north approximately 635 miles from the tagging site. Presumably, it left via the Chesapeake and Delaware Canal throught the Delaware River and Bay on its way toward New England.

(2) **Delaware**-This fish was tagged May 1, 1957, on the spawning grounds in the Elk River, near the mouth of the Chesapeake and Delaware Canal and was recaptured by a stake gill netter in Delaware Bay off Slaughter Beach, Sussex County, on May 23, 1957. When tagged with a Petersen disk, this male fish weighed 2 pounds, 10 ounces, but when recaptured the fishermen reported that its weight was 4 ounces less. Apart from the unreliability of a fish weight which could not be checked by a biologist, this loss in weight may be explained by a change in the reproductive condition. When tagged it was in ripe-spawning condition, but when recaptured the milt, or male reproductive product, was spent, hence it would weigh less. The fish was free for 23 days and travelled 66 miles, apparently through the Canal.

(3) **Virginia**-Tagged March 13, 1957, in Chesapeake Bay off Aberdeen Proving Grounds, this fish was recaptured in a pound net in Queen Sound Channel not far from the Atlantic Ocean, near Chincoteague, Accomack County, on November 10, 1957. The fish, a male tagged with a nylon streamer tag, weighed only 19 ounces. It was free for 243 days and presumably travelled south down Chesapeake Bay, went around the Virginia Capes and headed north, a distance of 230 miles. There is no evidence, however, to preclude the possibility that it utilized the Chesapeake and Delaware Canal in reaching its destination.

Only two returns were received from Chesapeake Bay, Virginia; all the rest came from the Maryland part of the bay. Virginia fishermen, however, accounted for a number of recaptures from the Potomac River. These two lower bay records are:

(4) **Virginia**-Tagged March 14, 1957, in the Potomac River off Popes Creek, this fish was recaptured in a pound net at the mouth of Plantation Creek, near Chesapeake Bay, a short distance south of Cape Charles, on April 30, 1957. It was free 48 days and travelled south of its tagging site for a distance of 113 miles.

(5) Virginia-Tagged March 14, 1957, in the Potomac River off Port Tobacco Beacon, this fish was recaptured by an angler in the Little Wicomico River near Smith Point, Northumberland County. It was free 121 days and had travelled a distance of 62 miles.

Most Tagged Fish Recovered Close to Tagging Site

The most important result of this tagging experiment is that 405 out of 410 fish were returned from Maryland waters. Most recaptures were taken in the general vicinity of the tag-and-release site, in spite of the time free. A small number travelled relatively greater distances within the bay; the maximum was 151 miles. Although a little over one-half of the fish were recaptured within a month of their release, 46 percent were at liberty more than four weeks and perhaps had ample opportunity to make extensive movements. The last tag returned by a fisherman up to the preparation of this article, for example, was taken from a pan-size rock that had been free 603 days, and yet had apparently travelled only about 12 miles from the marking site; i.e., from off the Aberdeen Proving Grounds to Swan Point Bar in upper Chesapeake Bay. Of course there is the possibility that during the mark-and recapture interim, the fish may have gone a considerable distance. At the other extreme, a male fish free less than one week travelled over 33 miles from the tagging site.

Larger Fish Travel Slightly Longer Distances Than Smaller Fish

Preliminary analysis of the tagging returns indicated that there was a difference, although small, between distances travelled by two arbitrary size groups of fish. For example, 83 male striped bass between 9 and 15 inches long (snout to fork of tail) averaged over 19 miles from the tagging site, while 22 male fish between 16 and 22 inches long averaged over 22 miles. The 227 fish of unknown sex between 9 and 15 inches long averaged 16 miles from the release locality, while 35 between 16 and 22 inches averaged 32 miles. When all fish were combined, the larger fish, on the average, travelled 10 miles farther than the smaller fish. Recaptures of a few of the larger striped bass over 15 pounds in weight indicated that the average distance travelled was about the same as the smaller fish.

Tag Recaptures Suggest Different Stocks of Fish in Bay

Tagged fish at a number of widespread localities in Chesapeake Bay stayed generally near the release sites, judging from a preliminary analysis of the recapture data. Such results suggest that greater credence may be given to the belief that the Chesapeake Bay striped bass may be composed of distinct stocks of fish that maintain their integrity throughout their life. Biologists from the Solomons Laboratory tagged fish at the following localities: (a) Upper Chesapeake Bay off Aberdeen Proving Grounds and Worton Point in March 1957; (b) Potomac River off Popes Creek and Port Tobacco Beacon in March 1957; (c) Elk River and Chesapeake and Delaware Canal in April and May 1957; (d) Chesapeake Bay near mouth of the Patuxent River at Cedar Point in June 1957; (e) Chesapeake Bay Channel from Cove Point to Worton Point in January 1958; (f) Choptank River at Ganey's Landing in April 1957; and (g) Patuxent River near Sheridan Point in April 1958. As indicated earlier, the only tagging on the spawning grounds was limited to the Elk River and the Chesapeake and Delaware Canal. The recaptures of five out of six fish almost exactly a year later at the Elk River tagging site suggests that fish may return each year to the same spawning ground.

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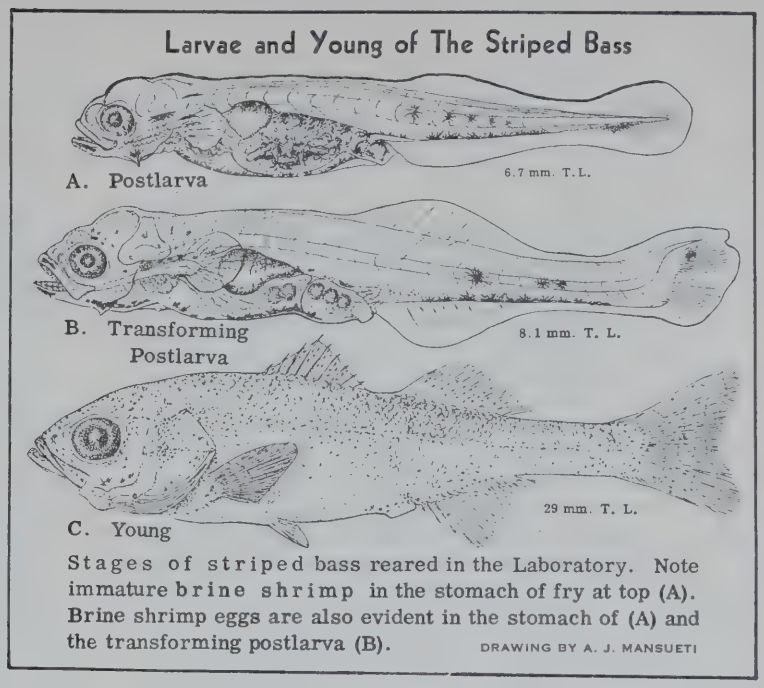
NEW PUBLICATION DESCRIBES HOW YOUNG STRIPED BASS OR "ROCK" WERE REARED SUCCESSFULLY IN LABORATORY

Of Great Value in Solving Problems of Fluctuating Supply and "Races"

How striped bass or "rock" were successfully reared in a laboratory is described in the Md. Department of Res. and Educ. publication, Contribution No. 112 entitled," Eggs, larvae and young of the striped bass, **Roccus saxatilis.**"All previous attempts to rear this species completely from larvae to the young fish stage by scientists elsewhere had failed until success was attained by the Chesapeake Biological Laboratory at Solomons. John Pearson, a U. S. Fish and Wildlife Service biologist, had succeeded partially when he reared larvae up to one-half inch by feeding them daphnia in aquaria and outdoor ponds in North Carolina during 1937. Rearing them completely through metamorphosis has enormous value in paving the way toward conducting further studies to determine the factor which cause striped bass to fluctuate greatly in supply from year to year, and for understanding more about the so-called "races" or sub-populations along the Atlanic Coast. Knowing these facts will bring more effective management of this important fish resource.



Stages of striped bass reared in the Laboratory. Note immature brine shrimp in the stomach of fry at top (A). Brine shrimp eggs are also evident in the stomach of (A) and the transforming postlarva (B). DRAWING BY A. J. MANSUETI

Fry That Feed On Immature Brine Shrimp Survive And Transform

Striped bass were successfully reared by feeding them immature, pin-point-sized daphnia and brine shrimp. Brine shrimp can be bought in most pet shops in the form of dried eggs; when placed in salt water they hatch in about 24 hours into a nauplius stage. Striped bass fry and young can be reared only in fresh water; therefore, shrimp were separated from salt water and introduced into the fresh water, where they lived from 12 to 20 hours if left uneaten. Daphnia, also known as water fleas, live in fresh water. At the small hatchery at Solomons, about 5,000 yolk-sac fry, about one day old, were distributed in 50-gallon and smaller aquaria for experimental feeding purposes. They were fed a variety of planktonic animal and plant food, including brine shrimp. About five days after hatching, a number of fish fry began to attack and attempt to engulf various food particles. Some successfully ingested immature daphnia. About five days later, they were successfully able to engulf the brine shrimp, which ranged in size from 1/8 to 1/4 the diameter of the fry's head These fish grew rapidly and were the most aggressive and successful in catching the shrimp and daphnia added twice daily.

Mass Deaths Among Fry Complicate the Study

Catastrophic deaths occurred in all the aquaria about two weeks after hatching among most of the fish that had absorbed their yolk sac, but which apparently had not been able to feed successfully. Thus, it is believed that they died from starvation. Such mass deaths are a common occurrence in the laboratory among the larvae of fish that produce large numbers of young unattended, and have been the primary reason why the early stages and the factors that affect their survival are little known. For a period of three to five days, dead and dying fish were found, so that only about 400 of the original 5,000 fry survived. The survivors were generally distributed in all aquaria and consisted of late-stage fry, transforming and fully transformed young fish. They foraged about on the bottom for food, coming to the surface only when food was introduced. During the period between three to five weeks, large-sized daphnia were introduced and eaten successfully. Between eight and fourteen weeks of age they were successfully fed amphipod shrimp taken by a plankton tow net over submerged grass in front of the Laboratory or from raised oyster trays. During the interim, specimens were systematically preserved and studied, but some of the survivors died out gradually until 14 weeks later, 50 small fingerling striped bass survived. At that time, they were accidentally killed by some unknown cause. Formaldehyde fumes, which water in an aquarium will absorb readily, was considered the primary suspect.

Descriptive Study of Early Development Will Aid Ecologist

Most of the material in the new publcation is devoted to detailed descriptions of the early development of the striped bass. Emphasis was placed on illustrating the variation in size and morphology, sequence of fin formations, changes in body form, and attainment of the full complement of meristic structures. An important part of the support for this study was supplied by the National Science Foundation, which supports basic research in all fields of science. One of the primary objectives was to provide a reliable diagnostic report to aid fishery ecologists in their efforts to separate the early stages of striped bass from other species with which it is found and confused in Atlantic Coast estuaries. Several interesting supplementary observations were made during the study. Hatchery reared striped bass demonstrated a slow rate of growth and were regarded as "stunted," when compared to growth rates of fish of the same age in the field. Descriptions and illustrations were also made of abnormal eggs and larvae, especially those that result from blue-sac disease and from a pugnosed abnormality. - R. J. MANSUETI.

MOVEMENTS OF YELLOW PERCH FOLLOWING SPAWNING IN SEVERN RIVER, MARYLAND

(CONTINUED FROM PAGE 21)

much less frequent. The recapture data suggest that the males remained in the spawning area or returned several times to the area but the female perch left the area after spawning.

Tagging of yellow perch on the spawning run commenced when the male perch first entered the spawning area on February 28 and continued until April 11 when the last ripe males were taken in the trap net. The first ripe female yellow perch was taken on March 1st and the last was tagged on April 5th.

Harvest of Tagged Yellow Perch by Hook and Line

Since the Severn River has been closed to all commercial fishing since 1920, all tag returns from within this river system represent hook and line catches. The number of tag returns continued to increase until the summer months when a slump in returns occurred and then increased rapidly during the fall months (Figure 1). Creel census data collected during 1957 on the nearby Magothy River revealed maximum fishing pressure during the summer months. Thus, the angler's catch of yellow perch is not related directly to heavy fishing pressure but rather to the seasons in which perch bite best.

As of December 1st, 125 tag returns from the 1281 yellow perch tagged in 1958 have been received. All of these anglers have reported the fish to have been caught within the Severn River. Tags returned during March and April were taken within one mile of the headwater spawning ground. Tag returns for the summer months were reported as far downstream as Annapolis where salinities range up to 13 parts per thousand. The largest number of tagged fish to date have been caught in the vicinity of Round Bay or approximately the middle of the Severn River where salinities are 6 to 8 parts per thousand. Recaptures during November have been mostly from Round Bay and further upstream. This year's tag returns illustrate a downstream dispersal of yellow perch following the termination of spawning but the spawning stock remained in the Severn River even though widely scattered downstream.

Ten Percent Angler Harvest Reported

Tag returns from 125 yellow perch represent an angler harvest to date of 9.8 percent of the total fish tagged. If only tagged fish one-half inch less than legal size (8.0 inches total length) or more are considered in the total number of tagged fish, then 125 returns from 1217 tagged fish represents a harvest of 10.3 percent. These estimates of yellow perch removal by angling should be considered minimal since non-reporting of tags, natural mortality following tagging and the loss of tags would all reduce harvest estimates of tagged fish.

Past Yellow Perch Tagging Studies in the Severn River

In 1955, 392 yellow perch were tagged on the Severn Run spawning grounds. Twenty-nine tags have been recovered by anglers from these fish. Only one tag was recovered outside of the Severn River and this fish was taken in the Magothy River. An entirely different movement pattern was found for 995 yellow perch transported from the Chester River and stocked in the Severn River at Indian Landing in 1956 (Maryland Tidewater News, 1957, Vol. 13(5): 1,6). Approximately two-thirds of the tag returns from these stocked fish were taken by commercial netters outside the river. The pattern of movement displayed by the spawning stock in 1955 and 1958 is similar but quite different from the pattern of transplanted fish. In general, the yellow perch on the Severn River spawning areas disperse downstream but remain within the river as a native stock. - R. J. MUNCY.

NOVEMBER CAPTURE OF THE BLUE RUNNER,

(CONTINUED FROM PAGE 21)

ing a median one) on the narrow part of the tail or caudal peduncle. The Carangids usually have one prominent keel of scales along this portion of the tail (see figure). The blue runner should never be confused with the pompano even though they belong to the same group of related fishes. The blue runner has an extremely long pectoral fin, a prominent keel of scales (with a smaller keel on each side) along the narrow caudal peduncle and a high arch to the row of special or lateral line scales along the body. The pompano, conversely, is usually deeper, lacks the row of scales along the caudal peduncle, has a short pectoral fin and no high arch to the lateral line scales anteriorly.

Blue Runner Usually Found In Warm Waters

The Carangid fishes are warm water fishes which have been recorded during the summer months from Halifax, Nova Scotia, to Recife, Brazil. In these waters, they swiftly dart about feeding on copepods, shrimp and small fishes. The blue runner seems to prefer water temperatures between 68-88° Fahrenheit. One specimen has been caught off Florida in water only 63° Farhenheit. Likewise, these fish are commonly found in waters of 33-36 o/oo salinity. Depths from the surface to 1400 feet deep have harbored specimens of this fish. The water temperature and salinity at the point of capture of the Maryland specimens were approximately 50° Fahrenheit and 17.0 o/oo respectively.

Of the 12 species of Carangid fishes known from Chesapeake Bay, only four, to date, have been taken in Maryland's portion of Chesapeake Bay and none occur in any abundance. The capture of blue runners in late November in the deep waters of Chesapeake Bay means that more investigations in these areas are needed to ascertain Carangid migrations or habitat preferences during the fall to spring months.-

F. J. SCHWARTZ.

STRIPPED BASS TAGGED BY SOLOMONS LABORATORY REMAIN LARGELY IN BAY

(CONTINUED FROM PAGE 22)

Work Is Part Of Cooperative Large-scale Tagging Study

This study is a part of the large-scale tagging study of striped bass in the Chesapeake Bay region carried out in cooperation with the Maryland Tidewater Fisheries Department, Virginia Fisheries Laboratory and the U. S. F. & W. S. Laboratory at Beaufort, North Carolina. In addition to work on migrations and biology, the major part of the study was devoted to a comparison of three types of tags: (a) Petersen disk, attached by means of a nickel pin stuck directly through the back of the fish; (b) nylon streamer tag, threaded through the hind portion of the back with a large upholsterer's needle and securely knotted; and (c) stainless steel jaw ring tag with a red Petersen disk. A report of this phase by cooperating investigators will be issued in the near future. A detailed report on the results of the tagging work by the Solomons Laboratory will also be issued in the near future. - R. J. MANSUETI.

MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION, Chesapeake Biological Laboratory, Solomons, Maryland.
L. Eugene Cronin, Director
Extract from the Maryland Tidewater News, Vol. 15, No. 1, Supplement No. 12, January-February 1959.

The Crayfishes of Maryland

By W. G. MEREDITH and F. J. SCHWARTZ

The crayfish is a member of the Class Crustacea, a large and varied group of animals that also includes the crabs, lobsters, shrimps, water fleas and barnacles. Although this assemblage of animals may seem at first glance to be quite unlike each other, they are all built on the same basic plan: jointed legs, a heavy crust-like shell or exoskeleton and gills for breathing under water. Most crustaceans are marine; of the ones that live in fresh-water, the crayfish is best known to most people.

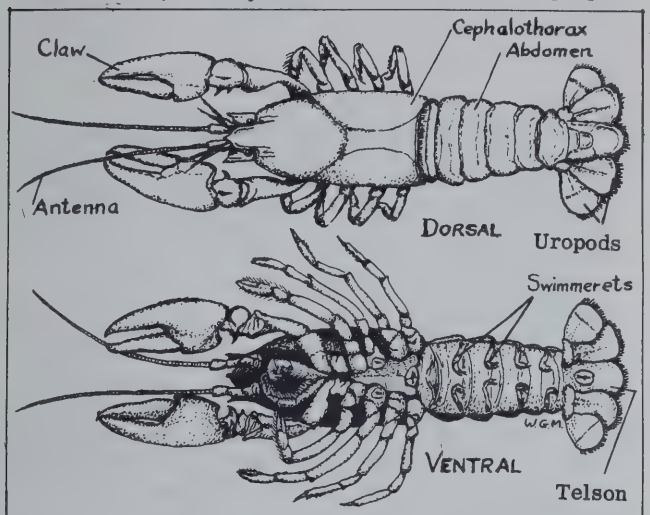


Figure 1. Adult Female Crayfish.

General Anatomy: The body of the crayfish consists of two major divisions, a cephalothorax in front and a "tail" or abdomen, which consists of six joints (Figure 1). The appendages are attached to the body in pairs. The first two pairs are antennae or feelers and are used for tasting, touching and smelling. Under the head are located a pair of powerful jaws and five pairs of small, jointed appendages which are used to pick up particles of food and guide them into the mouth. Located behind these are the large claws or pincers used for fighting, defense, and capturing food, and four pairs of walking legs. Each of the first five joints of the abdomen bears a pair of appendages called swimmerets. The first two pairs of swimmerets on the male are enlarged and stiffened, while on the female all five pairs are alike. The modified swimmerets of the males have distinctive shapes and are an important means of identifying the species found in Maryland (Figure 2). Swimmerets do not aid in swimming. In both sexes, the last joint of the abdomen, the telson, is enlarged and flattened and with its appendages, the uropods, it forms a broad paddle for swimming.

Crayfish occupy every conceivable aquatic habitat from marshes, streams and lakes to caves and have adapted themselves to each of these situations. The crayfish is a solitary bottom dweller, hiding by day under stones or in burrows waiting to grasp any food that passes within its reach. It resists attack with the strong claws and will avoid being drawn out of its shelter by darting backwards simply by extending the abdomen, uropods and telson and suddenly flexing them under the body. Crayfish are most abundant and evident in spring and early summer when they feed readily; in cold weather they retreat into burrows or safe hiding places below the water to await the spring.

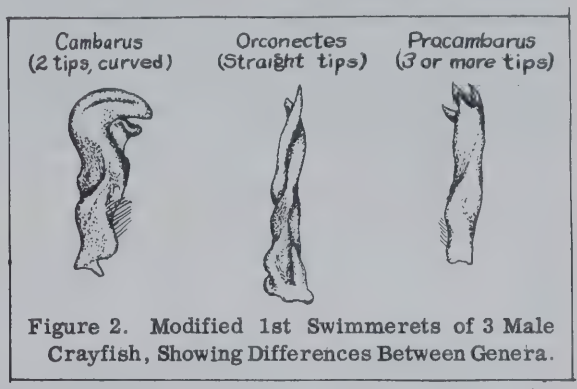


Figure 2. Modified 1st Swimmerets of 3 Male Crayfish, Showing Differences Between Genera.

Food of Crayfish: The food of these animals includes live insect larvae, worms, crustaceans, small snails, fishes, tadpoles and dead animal matter. Burrowing species subsist extensively on stems and roots of plants as well as on animal matter. The enemies of the crayfish, besides man, include fish, large salamanders, turtles, water snakes, herons, kingfishers, other birds, raccoons and some aquatic mammals.

Molting: A living crayfish can grow within its exoskeleton, but molting is necessary for any real increase in body size. Young crayfish molt several times during the year, while adults molt less frequently. Inorganic salts within the exoskeleton are removed while muscles and other structures reduce in size prior to molting. Usually on warm summer nights the old cuticle splits dorsally between the cephalothorax and abdomen and the crayfish slowly crawls and wiggles out of the old shell. Before the new shell hardens, an increase in size and bulk occurs.

Regeneration: Crayfishes, like jellyfishes and earthworms, are unusual in that they can replace lost parts, chiefly the appendages and eyes. Upon loss of any part, a new one is partly formed by the next molt, growing at each molt until it is fully restored.

Reproduction: Crayfish of the eastern states usually mate in early spring. The male grasps and inverts a female by seizing all her walking legs with his two claws and flexes his telson over the end of her abdomen so that she is motionless. He uses his fifth walking leg to press his modified swimmeret tips against a sperm receptacle on her thorax. Sperm passes down these swimmerets to be stored in these receptacles. The animals then separate. Days or weeks later, the female cleans her abdomen and swimmerets, lies upside down with her body flexed and emits a slimy secretion onto the swimmerets. Two hundred to 400 eggs are then emitted, fertilized by the sperm from the receptacles, and attached to the swimmerets. On the female's righting, the eggs, which hang down like berries, are aerated by fanning movements of the swimmerets. After five weeks a miniature, transparent crayfish is hatched.

These remain attached to the female's swimmerets until the second molt, after which they become independent of the female. By late fall these young are colored miniature replicas of adult crayfishes.

Economic Importance: Crayfish are of considerable economic importance. In some parts of the country, especially in the lower Mississippi Valley and the Southeast, burrowing species are very abundant, often numerous enough to cause serious crop damage. Also, their burrows are a nuisance around ponds, dams and levees. In some regions crayfishes are eaten in large numbers; in Louisiana in 1956, 1,221,200 pounds of crayfish, valued at $97,681.00 were harvested. In nature, crayfish play an important role as scavengers and as food for larger animals such as frogs, fish and raccoons. They are prized as bass bait by fresh-water fishermen, especially if they can be caught after molting and before their new exoskeleton has hardened.

Maryland Species of Crayfishes: There are some 70 or more species of crayfishes east of the Rocky Mountains while five species are known to occur along the west coast. Of the hundreds of collections of fresh-water fishes from every major watershed in Maryland, 64 collections were found and examined that contained crayfishes. Within these collections three genera and six species of crayfishes were found: Orconectes propinquus, O. limosus, Cambarus bartoni, C. carolinus, C. diogenes and Procambarus blandingi. When the locality of each species collection was plotted on a map of Maryland, an interesting pattern of zoogeographical distribution emerged. This pattern can be explained if one observes the topography of the state.

Physiography of Maryland: The State of Maryland, from east to west (Figure 3), cuts across three well-defined geographic zones. The Coastal Plain begins in the east at the Atlantic Ocean and extends roughly to an imaginary line from Wilmington, Delaware, to Baltimore, and then southwestward to Washington, D. C. The Coastal Plain is divided by Chesapeake Bay into two regions commonly called the eastern and western shores. The land in this province is relatively low and flat, exceeding 300 feet in elevation only in a few places. Consequently, the streams of this province, often intertidal, are slow-moving, deep, turbid with mud and sand, and possess brush-strewn bottoms.

The Piedmont, or middle zone, extends from the Coastal Plain westward to the foot of Catoctin Mountain, just west of Frederick, Maryland. The surface of the land here has a rolling character, consisting of foothills up to 850 feet in elevation and valleys of less than 400 foot elevations. The Piedmont is a transitional zone between the Coastal Plain and the third and most westerly zone, the mountains. These mountains are a series of parallel ridges running from southwest to northeast, some of which, in the western part of the state, reach elevations of more than 3000 feet. On the mountain sides, the streams have rock or boulder bottoms and are small, swift-running and clear except where polluted by coal mines or industrial wastes. In the valleys between the mountain ridges, the streams tend to widen, slow down, and meander, becoming similar to those of the Piedmont.

Species Distribution in Maryland: Of the six species of crayfishes collected, three occurred most frequently. Cambarus bartoni was collected at 20 localities. With the exception of one collection just north of Baltimore, all of these localities were in the mountains and the western part of the Piedmont province (Figure 3). Cambarus bartoni was found hiding under stones in the smaller, clear, cool streams of this area.

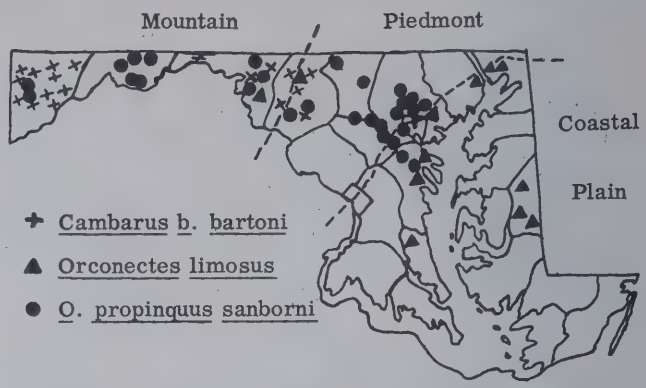


Figure 3. Geographic Distribution of 3 Species of Crayfishes within the Physiographic Regions of Maryland.

A second species, Orconectes limosus, appeared in 12 collections. It was found different from C. bartoni in its choice of habitat, for all but two localities occurred in the Coastal Plain (Figure 3). O. limosus apparently prefers the slow-moving, turbid streams of this region.

A third species, Orconectes propinquus, was the most widely distributed species collected. It occurred at 28 localities, ranging from the western shore of Chesapeake Bay to the mountains of Garrett County in the west (Figure 3). It appears to survive in a variety of stream types, but seems to thrive best in typical Piedmont streams. Where it occurs in the Mountain Province, it inhabits the larger streams in the valleys rather than the small, swift mountain streams. O. propinquus may be more resistant to pollution than the other species, for five of the collections in which it occurred were from polluted streams.

Of the remaining three species, Procambarus blandingi was represented in one collection from Wicomico County on the Eastern Shore. Cambarus diogenes, a burrowing species, which might be expected to occur in the Coastal Plain and Piedmont areas, was captured at only two localities on the Western Shore, Calvert and Anne Arundel Counties. Cambarus carolinus, another burrowing form, was found at a single locality in the Potomac River in Allegheny County, although it is expected to occur throughout the mountains of the state.

The distribution of crayfish in Maryland seems to follow closely the physiographic areas of the state; however, several factors not covered herein must be investigated in order to strengthen this observation. First, several counties, notably those on the Eastern Shore and along the lower Potomac River, were not represented well in the present survey. Collections from these areas would undoubtedly extend the ranges shown here, and might add more species to the list of those known to occur in the state. Second, since the original objective in making the collections was to catch fish rather than crayfish, many specimens may have been overlooked or ignored, hence perhaps the absence of O. obscurus and C. montanus acuminatus, which are expected within the state. Third, little effort has been made to collect burrowing species, such as C. carolinus, C. diogenes and the expected C. mongalensis and C. uhleri, which are not usually captured by ordinary seining methods.

EXPLORATORY TRAWLING FOR STRIPED BASS IN POTOMAC RIVER, 1959

Cooperative Research Project Undertaken

Fishery biologists from the U.S. Fishery Laboratory at Beaufort, North Carolina, Virginia Fisheries Laboratory at Gloucester Point, Virginia, and the Chesapeake Biological Laboratory at Solomons, Maryland, completed three weeks (from January 19 to February 4) exploratory trawling for striped bass or "rock" in Maryland's Potomac River. Various size trawl nets ranging from 30 to 60 feet in width were dragged over the bottom.

The cooperative venture, carried out on the research

OTTER TRAWL BEING HAULED ABOARD PATHFINDER

vessel, **Pathfinder,** of the Virginia Fisheries Laboratory, was designed to: (a) locate wintering schools of striped bass in the river; (b) determine the feasibility of tagging enough fish to learn certain important aspects of their life story and distribution in the fishery; and (c) discover whether the population size of specific size groups can be estimated by a mark-and-recapture study before the gill net fishing season officially begins in mid-March in the Potomac.

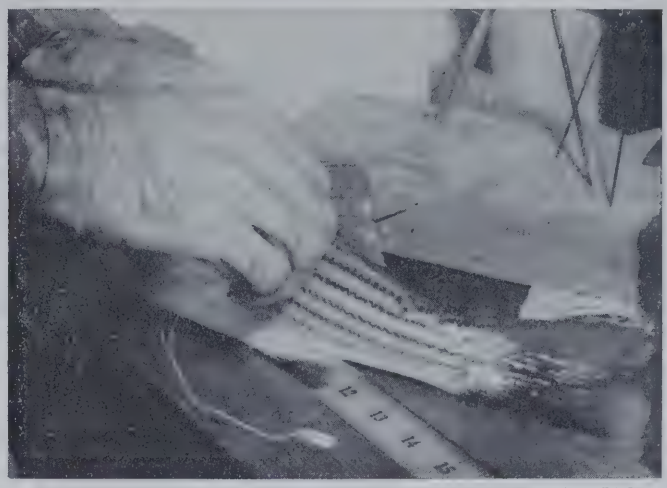
Striped Bass Scattered at Depths of 30 to 100 Feet Over 35-mile Area

Striped bass were found distributed at various depths from 30 to 100 feet at many locations from the vicinity of the Potomac River Bridge (U.S. Route 301), about 40 miles above the mouth of the river, to the region above Quantico, about 70 miles above the mouth. Virtually no striped bass were caught at stations spaced five miles apart from Piney Point, 15 miles above the mouth, to the area just below the Potomac River Bridge (Route 301).

Striped bass caught in slightly brackish water far upstream were largely small fish. Those taken in the 10-mile span immediately above the bridge, where salinities ranged from 7 to 11 parts per thousand, were on the average larger. All fish, whether from shallow or deep areas, were very active although bottom temperatures ranged from 34 to 37 degrees Fahrenheit.

White Perch Dominates Trawl Catches

Considerable numbers of white perch were trawled; in fact, these fish exceeded striped bass catches by 10



STRIPED BASS TAGGED WITH NYLON STREAMER TAG

to 20 times. In one 15-minute tow with a 30-foot semi-balloon type trawl, well over 10,000 white perch were estimated in the catch. Excluding the thousands of fingerling white perch, most of the adults ranged from 6 to 8 inches long. A few white perch were taken weighing up to 1 1/2 pounds each. As observed among striped bass, the larger white perch were found downstream in deeper waters, with a gradient of smaller fish to shallower and fresher waters upstream.

Tagged Striped Bass Ranged From 1/4 Pound to 11 Pounds in Weight

Although roughly 10,000 striped bass were caught by trawl, only 739 fish were tagged and released. The majority of the fish caught consisted of fingerling and yearling fish under 10 inches in length which were released untagged to the water. Measurements were taken from many of these fish and a small number were preserved for stomach content and other studies. The tagged fish ranged from 10 to 30 inches long, and weighed from 1/4 pound to almost 12 pounds with the majority ranging from 1/2 pound to 2 1/2 pounds. These were tagged with a nylon streamer tag, the thread of which was inserted under the second top-fin (soft dorsal) with the help of a long upholsterer's needle (see photo). The small, yellow, rectangular tag has a number on one side while the other side contains directions as to where recovered tag should be sent for a $1.00 reward.

Results of Trawl Survey are Currently Being Evaluated

Not all the objectives of the survey were fulfilled. Many obstacles were encountered and several nets were lost during the survey. Although the winter quarters of Potomac River striped bass were located, no concentrations were found in the deepest holes as anticipated. Rather, they were generally scattered over most of the trawled bottom. Although a substantial number of striped bass were tagged in a short time, the results of the survey, which are currently under careful study by Virginia, Federal and Maryland biologists, cannot be evaluated conclusively at this time. After the cooperative analysis, further work in the Potomac will be undertaken. In the meantime, the winter-tagged fish, when recapture and reported by netters and anglers, will yield valuable information on the movements and biology of the Potomac River stock.

Trawling Survey is Part of Larger, Long-range Study of "Rock"

The trawling survey is part of a larger, long-range, cooperative study of the striped bass migrations, bio-

(CONTINUED ON PAGE 4)

MARYLAND COMMERCIAL FISHERIES PRODUCTION 1957 AND 1958 - CHESAPEAKE BAY

Total commercial production of finfish from the Maryland Chesapeake Bay system in 1957 shows an apparent increase in weight of one per cent from the mean of the 13 year base period (1944-1956) of prior departmental catch records. The 1958 total, based on about 95 per cent licensed record returns, shows a five per cent increase when compared to the same mean (Table I). All Maryland statistics in this article were compiled by the Maryland Department of Research and Education at Solomons, from the records of licensed commercial fishermen. **All 1958 calculations are based on preliminary totals and are subject to change when all licensees' records have been received.**

Average Price and Mean Value for 1957 and 13 Year Base Period Compared

The average wholesale price for fish during 1957 was 8.5 cents per pound, while the mean price for the base period (1944-1956) was 9.0 cents per pound. The average price had decreased by six per cent. The 1957 total wholesale value for the following species, compared to the species mean values for the base period, increased by the percentages shown: Carp 33, catfish 22, shad 52, spot 113, and menhaden (bunkers) 243. Wholesale values for these other important species decreased by the percentages shown: Alewives (glut and branch herring) 24, croaker (hardhead) 29, striped bass (rock) 8, gray trout 82, white perch 41, and yellow perch 50.

Production of Some Important Species Changed

The following food fish landings for 1957 increased in weight, when compared to species mean weights for the 13 year base period, by the percentages shown: Carp 114, catfish 1, shad 80, and spot 114. Menhaden, a non-food fish, increased by 108 per cent. The following food fish catches decreased for 1957 by the percentages shown: Alewives 22, croaker 22, striped bass 23, gray trout 83, white perch 39, and yellow perch 52.

TABLE I

Maryland Chesapeake Bay Commercial Catch Statistics for Important Species for 1944-1956, 1957 and 1958

	WEIGHT			VALUE		
	THOUSANDS OF POUNDS			THOUSANDS OF DOLLARS		
SPECIES	13-YR. MEAN (1944-'56)	TOTAL 1957	TOTAL 1958 ★★	13-YR. MEAN (1944—'56)	TOTAL 1957	TOTAL 1958 ★★
Alewives	4,381	3,402	4,299*	90	68	
Carp	437	937	614*	21	28	
Catfish	472	477	374*	27	33	
Croaker	1,633	1,279	623*	180	127	
Shad	1,211	2,178	1,725*	184	280	
Spot	174	372	586*	16	34	
Striped Bass	2,262	1,747	2,854*	495	454	
Trout, Gray	548	94	38*	67	12	
White Perch	896	550	664*	85	50	
Yellow Perch	136	65	40*	20	10	
Menhaden	1,151	2,399	2,279*	14	48	
All Fish	13,581	13,665	14,295*	1,225	1,157	

* Preliminary Data.
★★ Not Available.

Compared to species mean weights for the base period, the 1958 food fish landings for the following increased by the percentages shown: Carp 40, shad 92, spot 237, striped bass 26. Menhaden increased by 98 per cent. The species that follow decreased in catch for 1958 by the percentages shown: Alewives 2, catfish 21, croaker 62, gray trout 93, white perch 26, yellow perch 71.

Spot alone, of the summer migrants from the Atlantic Ocean, came in larger sizes and quantities during 1957 and 1958. Croaker and gray trout catches disappointed fishermen both years. Striped bass landings dropped in 1957 when the "keeper" limit was increased from 11 to 12 inches on June 1. In 1958, striped bass reached a production peak second only to that of 1950. Biologists in this department attribute this peak to a dominant year class of striped bass in 1956.

Gear Use Drops to New Low in 1957

Amounts of all kinds of gear actually used, with the exception of anchor gill nets, dropped below the amount used in 1956. More men fished but they used fewer boats. The 1957 use amounts are also lower than the 13 year mean gear-use amounts (1944-1956) except for anchor gill nets and motor boats. Gear-use data for 1958 are not available at this writing.

Annual Fluctuations Appear to Be Normal

For the years immediately preceding 1957, i.e., from 1953 to 1956, the total annual production had been progressively higher (See Maryland Tidewater News, Vol. 13, No. 10, Nov.-Dec. 1957). (During the base period, 1944-1956, the 1956 peak in total production had been surpassed only in the years 1950 and 1951). For the whole 13-year base period, the annual fluctuations appear to be normal. The Maryland trend compares favorably with the gross trend for all seafood production of the United States for the same period (U. S. Fish and Wildlife Statistical Digest No. 43). Whether these annual changes are based on (a) economic factors, (b) availability of the desired species, (c) a combination of (a) and (b), or other factors has not been considered in this article.- G. J. MURPHY.

EXPLORATORY TRAWLING FOR STRIPED BASS IN POTOMAC RIVER, 1959

(CONTINUED FROM PAGE 3)

logy and fishery in the Potomac River. Work in the river has resulted after several years devoted to a comparison of the returns on several type of tags on striped bass and to a general tagging program of striped bass throughout Chesapeake Bay. The bottom-dragging effort provided a necessary prelude to extensive work in the Potomac River in the near future. - R. J. MANSUETI

A MOST UNUSUAL ANIMAL

(CONTINUED FROM PAGE 2)

tling of **Molgula** on the siphons, kiling the animals and indirectly causing them to be uprooted from their burrows. The common blue crab has been known at times to eat large numbers of sea squirts (**Maryland Tidewater** News 13(3): 3). - D. W. LEAR.

OYSTER LOSSES IN DELAWARE BAY CAUSE ALARM

(CONTINUED FROM PAGE 1)

spreading infestation and such occurrences should be reported at once. The greatest amount of oyster mortality occurs from March to May and again during the fall. This spring should indicate whether natural conditions may check the mortality or whether it is spreading into other oyster producing areas. While everyone concerned fervently hopes that the condition has run its course, all possible safeguards should be taken immediately as a measure of insurance against possible further disastrous oyster losses. - G. F. BEAVEN.

MARYLAND TIDEWATER NEWS

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EDITORIAL STAFF: J. R. LONGWELL, J. H. MANNING, E. A. DUNNINGTON, G. J. MURPHY, AND R. J. MUNCY.

Volume 15 JANUARY — FEBRUARY, 1959 No. 1

OYSTER LOSSES IN DELAWARE BAY CAUSE ALARM

Extent of Mortality

Oyster producers and biologists are gravely concerned by the extensive oyster mortalities that have occurred during the past two years in Delaware Bay. At recent meetings scientists from Rutgers University and the New Jersey Oyster Laboratory reported that heavy losses from an unknown cause occurred during the spring of 1957 and have been continuing. During the entire year of 1957 the oyster deaths averaged about 70 per cent near the center of the producing area and were less towards the upper and lower portions, with no unusual losses on the outer or western part of the plantings and none along the eastern side. In 1958 a second wave of heavy mortality occurred that covered all of the planted beds and extended during the past fall into the seed beds. At present the entire bay, in both New Jersey and Delaware, is affected. New plantings made last spring grew in early summer but during the fall and early winter losses of 40 to 60 per cent occurred. The combined loss for the two years on older planting averages about 80 per cent and has been as high as 94 per cent near the center. The result has been that Delaware Bay oyster production within a year has dropped to about 10 per cent of its original figure and is now virtually at a standstill.

Cause of Losses Sought

Drills, crabs, mudding, etc., are recognized causes of oyster deaths in Delaware Bay, but these account for only a relatively small portion of the present oyster losses. The southern fungus, **Dermocystidium marinum,** has been found in Delaware Bay, but is absent in many of the areas of high mortality, and is not responsible for the present losses which have occurred principally in spring and fall, while **Dermocystidium marinum** losses appear in hot weather. The pattern of the oyster mortality resembles closely those that have occurred in Canada near Prince Edward Island and that have been referred to as the Malpeque disease of oysters. However, the causative agent for the Canadian losses has not been identified and it is not known at present whether or not the Delaware Bay losses may be of the same nature. One unknown fungus organism has been found to be present in oysters from the affected areas and also in oysters from several areas on the seaside of Maryland and Virginia. Whether this may cause oyster mortality, or simply may be associated with weakened oysters, has not yet been determined. More intensive studies of this organism and of other micro-organisms found to be associated with the dying oysters are underway. Fortunately, in the areas of oyster blight, other marine life continues to thrive and the safety of the oysters as food is not affected.

Possible Control Methods

It is possible that the disastrous Delaware Bay mortality may have been triggered by environmental factors and may not spread further. It appears more likely, however, that it is the result of an agent that is infectious to oysters and can spread rapidly from affected to unaffected oysters under proper conditions. Because of this danger oysters and shells should not be transferred to other waters from Delaware Bay or from any areas where the blight may be present. In Canada, where cold water barriers isolate one oyster producing area from another, a strict embargo on transfer of oysters from infected to uninfected areas proved very affective. However, an almost continuous belt of oysters extends along the coast south of Delaware Bay and into the Chesapeake, so that any organism responsible for the blight may eventually spread by natural means if the Chesapeake Bay environment proves favorable to it. Any slowing down of the mortality's spread, can be very helpful in providing time for a more rapid rehabilitation through the development of native resistant stocks of oysters.

In the Malpeque mortality from one to five per cent of the oysters survived and produced increasingly resistant generations of offspring. Under natural conditions about 20 years were needed to restore the affected area with resistant oysters. In later outbreaks in Canada the introduction and cultivation of resistant oysters halved the time of recovery. For restoration of Delaware Bay, the survivin oysters are to be concentrated in brood sanctuaries at favorable locations so that resistant progeny can develop as rapidly as possible. If similar mortalities occur in the Chesapeake Bay, then the same plan for developing locally resistant oysters will be needed. Meanwhile, as a safeguard, plantings of Chesapeake oysters can be made on Delaware Bay sanctuaries where a resistant Chesapeake strain could begin to develop before extensive mortalities in the Chesapeake occur. At present, as far as is known, there is no evidence of any mortality in the Chesapeake of the same nature as the blight that has devastated the oysters of Delaware Bay.

Alert Observation Needed

Indications of further spread of the mortality should be carefully watched for, especially by Chesapeake interests wherever Delaware Bay shell stock may have been brought in during the past two years for either planting or shucking. There is some indication that the condition already may be present at spots along the Maryland-Virginia seaside. Until the cause is known, sharp upturns in mortality are the only indications of

(CONTINUED ON PAGE 4)

A MOST UNUSUAL ANIMAL

What animal stands on its head as a baby, turns inside out to become an adult, has its "lungs" in its "throat", is both male and female, reverses its heartbeat and contains some plant-like material? These little creatures go by many names. In the Chesapeake Bay area they are variously known as "blisters," "toad eggs," "dog stones," "sea grapes," and "sea squirts." They are known scientifically as **Molgula manhattensis.** Scientific names do have meaning, for **molgos** is the Greek word for skin or hide, which is descriptive of this creature because of it tough outer "skin" or tunic. The "skin" or tunic of **Molgula** is, oddly enough, made of a cellulose-type plant-like material, rather than from materials of which most animals are made. The meaning of **manhattensis** is equally descriptive of its general location, or perhaps its preference for beverages.

When taken from the water (they neither sting nor bite, and can be safely handled), oftentimes one will eject a tiny stream of water several feet. This accounts, naturally enough, for the name "sea squirt." In the water the two siphons can be seen, but these are quickly contracted when the animal is disturbed; therefore, the sea squirt appears as a jelly-like round blob when it is handled.

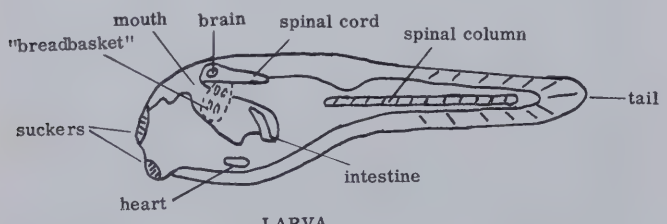
"Sea Squirts" Widespread in Cheaspeake Bay

On submerged objects in the Chesapeake, from the Bay Bridge at Annapolis down the bay, these greenish-brown grapelike creatures may be seen singly or in clusters. In the bay sea squirts are more abundant in fall, winter and spring than in summer. The new crop appears in the fall while related species in other regions reproduce all year. Incidentally, these relatives are really cosmopolitan, occurring from cold polar seas to the warm shores of the tropics.

Each individual **Molgula** can be both male and female, for each contains both sex organs. (Who gets the exemptions when tax time comes around? Maybe they file joint returns - **Editor's Note).** The eggs and sperm are released into the water to either unite among themselves, or with eggs and sperm from another individual. In other (longer) words, they are self-fertile and cross-fertile. A careful cousin of **Molgula manhattensis, Molgula citrina,** that lives in colder northern waters, takes better care of the sperm and eggs. These are released into the rear chamber (cloaca), where they unite and are held until they develop enough to swim away as larvae.

Young Sea Squirts Quite Different From Adults

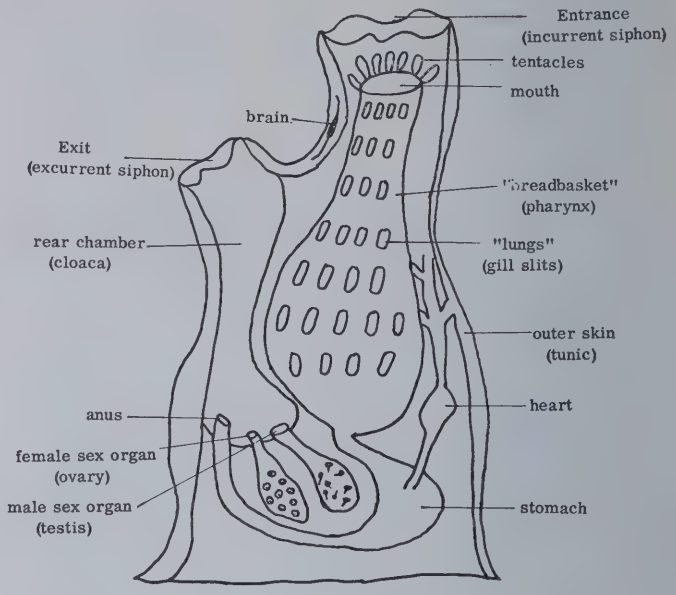
Another turnabout in the story of **Molgula** is that some structures are more completely developed in the larva



LARVA

than in its parents. The free-swimming larva has a rudimentary backbone (notchord) and nerve cord. It has a long thin tail and somewhat resembles a tadpole. After swimming away its youth, it attaches itself by the "suckers" on its head to some firm object in the water. While standing on its head, the internal organs do a complete flip-flop (slowly, of course) until what used to be the tail becomes the head. During the process, it loses its notchord. As a juvenile, **Molgula** is free-swimming, but after settling it retires from active life and never moves (under its own power) from its settling spot. In other words, it becomes a sessile organism.

This creature does the "mostest with the leastest." In addition to harboring both sex organs, it can reverse its heartbeat and also combines its feeding and breathing appartus. The heart action in this creature has been observed pumping merrily along in one direction, then suddenly reversing its direction entirely. And some observations have indicated that both ends of the heart sometimes get mixed up and beat towards each other!



ADULT

This remarkable animal feeds by pumping sea water in the entrance (incurrent siphon) and catching microscopic creatures in its "breadbasket" (pharynx). This pharynx is lined with a "fur" of tiny hair-like organs called cilia, which beat in unison, giving the appearance under a microscope of wind blowing over a wheat field.

These cilia cause the water to flow through the animal. Tentacles at the mouth act to reject large or harmful particles from the stream. Certain cells in the pharynx secrete a mucous "shopping bag," which traps the food particles, and the mucous sheet with its adherent particles is then eaten by being taken into the stomach for digestion. This "breadbasket" is also the "gills" of the animal. The holes (gill slits) are provided with cells that exchange waste carbon dioxide for life-giving oxygen dissolved in the flowing water. Blood vessels run from the pharynx to other parts of the body.

Molgula is really an anomaly (odd-ball) in the animal kingdom for, as we have seen, it has features characteristic of the higher animals, the chordates (animals with notochords including all the backbone animals) in its larval stage, but when it settles to become an adult it reverts to a much more primitive form.

Economic Importance at Present Limited to Fouling

Our thick-skinned friends are harmless creatures, and their chief importance to us is their role as a fouling organism (such as are barnacles and mussels). They cannot cling very tightly, so they are not especially important as fouling on boats. Their great numbers, however, have been supected at times as a cause of the death of oysters by simply smothering them. In one instance dead maninose clams was attributed to the set-

(CONTINUED ON PAGE 4)

MARYLAND TIDEWATER NEWS

Entered as Second Class Matter at Solomons, Maryland. Office at Chesapeake Biological Laboratory, Solomons, to which all communications should be addressed.
EDITORIAL STAFF: J. R. LONGWELL, J. H. MANNING, E. A. DUNNINGTON, G. J. MURPHY, AND R. J. MUNCY.

 Published bi-monthly by the Staff of the Maryland Department of Research and Education.
L. Eugene Cronin, Director

Volume 15 MARCH — APRIL, 1959 No. 2

CAPTAIN HARVEY MISTER RETIRES FROM STAFF

Ever since biological research was initiated at Solomons Island, Captain T. Harvey Mister has been an important part of the Staff. On March 31st of this year, he retired after completing almost 35 years of service with the State of Maryland. He had worked as an inspector for the Department of Tidewater Fisheries, as a boat captain for the Laboratory, and as the Superintendent of Shad and Yellow Perch Hatcheries for the State.

"Captain Harvey" has been a friend of scores of research workers and students during the past 25 years at Solomons. He has taught many of them the rudiments of boat handling, safety precautions on the Bay, and the pleasure to be had from quick Irish wit.

In the seasons between operation of the Hatcheries, he has constructed many kinds of equipment from strong, able rowboats and crab floats to laboratory cabinets and special instrument cases.

The Staff of the Department of Research and Education salutes his long service and joins his many friends in a wish for many pleasant years of retirement and, especially, good luck in his favorite recreation - fishing in the Chesapeake. L. E. CRONIN

FISHERMEN AID SCIENTISTS IN TAGGING AND CREEL SURVEY OF SUSQUEHANNA FISH

Fishermen have contributed greatly to the success of 1958 and 1959 studies of fish movements and fishing harvest and intensity in the lower Susquehanna River, according to biologists of the Susquehanna Fishery Study. Maryland and Pennsylvania fishermen have been diligent and cooperative in turning in tags from striped bass and shad and providing necessary information to those making creel surveys.

In 1958, for example, 5,478 fish were tagged, of which 4,034 were planted above Conowingo Dam. Of these, 2,983 were shad and 2,495 were striped bass. From tags returned, the scientists were able to estimate that about 400 shad and 500 striped bass survived downstream passage through the turbines of Conowingo Dam. Shad recaptures, incidentally, were mainly from upper Chesapeake Bay, while some came from Virginia and one was taken off Portland, Maine. Most of the returns of striped bass tags were from upper Chesapeake Bay.

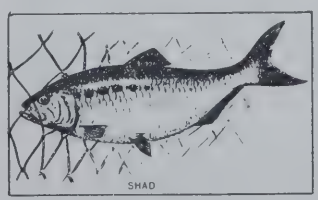
Fishing Pressure High in 1958

The creel survey from April through November, 1958, was based on three areas: (1) Conowingo Lake; (2) catwalk on the tailrace of the Dam, and (3) lower Susquehanna River below the Dam to Chesapeake Bay. The survey indicated high fishing intensities. For every 100 hours of fishing, the average angler caught 70 fish (mostly crappies and catfish): in the lake; 80 fish per 100 hours from the tailrace (mostly channel catfish); and 30 fish per 100 hours in the river (mostly catfish). At the tailrace of the dam where space was at a premium, the catwalk supported seven times as many fishermen-hours per unit of space as the river and 50 times as many as the lake.

Biologists estimated that 73 per cent of the fishermen in tidal waters were non-resident, and 14 per cent in inland waters were non-resident. They discovered that 99 per cent of the non-residents were from Pennsylvania. Tidal waters in the lower Susquehanna River extend from the confluence with Chesapeake Bay to Port Deposit, where an artificial boundary is defined by law. Inland waters extend upstream.

Cooperation Asked

Fishermen are asked once again to look out for tagged shad and striped bass. This phase is being carried out with U. S. Fish and Wildlife Service. When a tag is returned with full information of where, when, how the fish was caught, a reward of $1.00 is given for each tag. Anglers will be approached and interviewed during 1959, and will be given voluntary reply postal cards. On these, they will be requested to furnish information on time fished, species caught, residence and other details. Occasionally, biologists will examine the catch. The three areas will once again be studied by means of counts of cars, boats and fishermen.



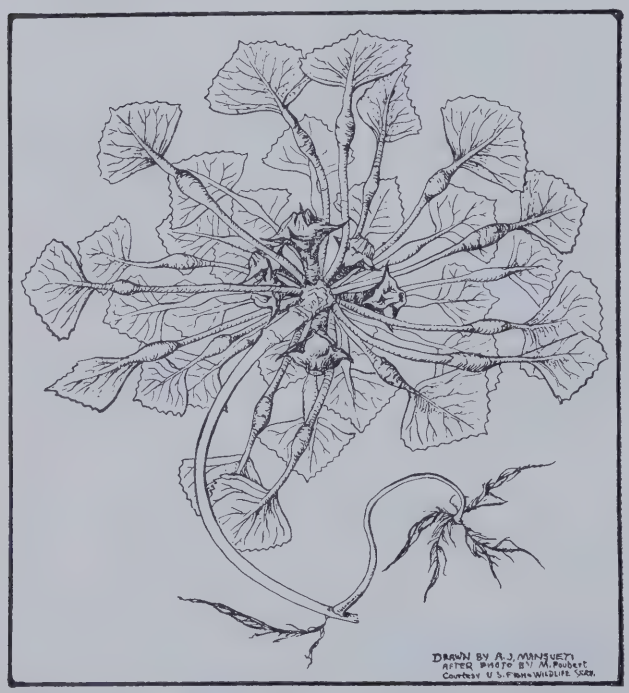
THE WATER CHESTNUT DOWN BUT NOT OUT!

Nuisance Abated

A dangerous natural enemy to Maryland waterways will soon again put in its seasonal appearance in the Gunpowder River area. This vicious pest is the water chestnut, **Trapa natans,** a weed whose growth is capable of destroying boating, fishing and swimming. Thanks to cooperative efforts of departments under the Maryland Board of Natural Resources, this foreign invader has been effectively attacked during the past few years and its ranks greatly reduced. Underwater weed cutting, spraying and hand cutting are the control methods applied by personnel of the Departments of Tidewater Fisheries and Game and Inland Fish. These have destroyed most of the weeds each summer and left the waterways little hampered by the pest.

Last Embers Must Be Stamped Out

Just as a brush fire is dangerous until the last spark is extinguished, so is water chestnut dangerous until the last live plant or seed is destroyed. While the remaining scattered water chestnut plants are no great nuisance, they are capable of quickly invading the entire area if control efforts are relaxed. The abundant seeds dropped by each mature plant can



Rosette of Water Chestnut Shown from the Underside Which Floats in the Water.

remain dormant in the bottom and come up as late as ten years after the parent plant is gone. Continued efforts will be needed this season and for a number of future seasons in order to remove the threat of future choking beds that can develop rapidly. This means that not a single plant must be allowed to grow and produce seeds for a ten year period or until they no longer can be found.

Need For Vigilant Patrol

Large-scale attack on dense beds probably will not be necessary this year if past efforts have effectively prevented the shedding of new seeds. Experience indicates that only scattered plants from old seeds should appear during this and the next few years. These can be sought out and removed by hand through a careful and continued patrol during the summer months. All areas where the plants once grew and nearby waters should be inspected repeatedly during the growing season - late May to August.

Some seeds from past crops may possibly have gotten into new areas. Thus, every citzen using our freshwater streams and ponds can help keep a constant lookout for this plant, remove it from the water and notify the Board of Natural Resources, State Office Building, Annapolis, if a new area has been found invaded. The accompanying drawing makes the plant easy to identify. Effective control efforts must be continued not only to keep the pest down, but to knock it out completely before our vigilance can be relaxed.

G. F. BEAVEN.

OCEANOGRAPHERS SURVEY CONOWINGO LAKE

Oceanographers of the Chesapeake Bay Institute of The Johns Hopkins University have shed their sea legs in order to study the physical features of Conowingo Lake, located about 10 miles from brackish water of the upper Chesapeake Bay. The investigation, which began on April 1, 1959, will continue for one year.

Environment To Be Studied

The present environmental conditions of the reservoir will be surveyed in relation to the basic needs of eggs and fry of migratory fish that might spawn there. Specifically, hydrographic research work in Conowingo Lake will be devoted to the determination of: (1) character of water movements in relation to inflow, outflow, wind and temperature layers below the surface; (2) location, nature and changes in temperature in the impoundment; (3) character of bottom materials, amount of suspended sediment and light penetration in the reservoir; (4) seasonal distribution of dissolved oxygen, pH and alkalinity at various depths and locations in the reservoir; and (5) the presence of any toxicants or pollutants in the reservoir.

Survey Under Susquehanna Fishery Study

The oceanographers will coordinate some of their activities with those of the parent Susquehanna Fishery Study. The latter is administered by the Maryland Department of Research and Education and sponsored by the Philadelphia Electric Company. Preliminary studies on the physical character of the lake have been carried on by biologists of the Susquehanna Fishery Study and Maryland research agencies.

CONTINUED ON PAGE 8

MUSSELS MUSCLING IN

The common black mussel, **Mytilus edulis** Linn., a common sight along the sea coast of North America and Europe has been found under unusual circumstances in the Chesapeake Bay. It seldom occurs far from the ocean probably because of an intolerance to low salinity. Generally, the salt content of the water where this species is found ranges from about 35 parts per thousand in the ocean to about 15 parts per thousand in brackish waters. This bivalve with a smooth, black, lustrous shell is widely used for food in Europe.

Unusual Number of Mussels Attached to Blue Crab

On February 26th of this year, an adult female blue crab almost seven inches wide was brought to the laboratory at Solomons. This crab, alive when caught the day before, was literally covered with mussels of this species. A careful count revealed a total of 213 mussels, ranging from ¾ to 1½ inches long, attached to this crab. This crab was taken, along with hundreds of others in similar condition, in a dredge near Smith Point, Virginia. The mussel, when setting, attaches itself to stones, rocks, logs, etc., by a strong, elastic, thread-like hold fast called a byssus. These byssal threads covered much of the abdomen, joints of the walking legs, claws and mouth parts of the crab. Furthermore, the claws were flexed under the body of the crab and were firmly held in position by these threads. It appeared impossible for the crab to free her claws from these bonds. The eyes, however, were not covered. The gill cavities of the crab, as is common in winter, were heavily silted.

The occurrence of sessile animals such as barnacles, oysters and mussels on crabs is not a rarity, but the degree of setting in this case is indeed extreme. According to watermen in the area, these encumbered crabs were quite abundant in the area during the latter part of February. It is interesting to consider how this association came about and the adverse effect such a great encumbrance must have on the crab.

Possible Explanation for Mussel Attachment

The female crabs, after mating, move toward the mouth of the Chesapeake Bay during the late fall and winter. They are found throughout the lower part of the bay, generally congregating in schools. They spawn during the summer and are thought to remain in this general area until the next year when the second or last spawning is accomplished. The movements of crabs after the first spawning are thought to be non-directional and limited. However, no detailed studies have been made of these movements.

The area where the carbs were caught was in relatively deep water, a habitat suitable to the setting and growth of this mussel. In the deeper parts of the Chesapeake where the salinity does not go below 15 parts per thousand, these forms often cover objects in a similar fashion. The mid-bay region has populations of another mussel, **Volsella demissus** Dillwyn, the ribbed mussel, which is tolerant of lower salinities and this animal is occasionally found attached to crabs, but never in such overwhelming numbers.

Possibilities As Biological Tags

Occurrences of this kind suggest the possibility of using attached organisms as biological tags to determine the migratory travels not only of crabs but of many other animals where similar associations of two or more organisms exist. - D. G. CARGO.

MARYLAND FISHERIES TRENDS, MARCH 1959

OYSTERS: Conditions remained about the same as last month with demand down slightly and supply light. The dredging season on public beds closed on the 15th of March. Due to the light supply many shucking houses operated only one or two half days a week. Wholesale prices remained the same as those of February, averaging $2.25 - $3.50 per Maryland bushel.

Oystermen in the Chincoteague Bay area experienced losses of about one-third in their expected crop this season. The actual cause was not known. Some suggested theories were: Smothering by large amounts of algae which were induced by the large amount of fresh water from rain in spring and early summer, abundance of oyster drills, and large numbers of bullfish (rays) which feed on the oysters. Wholesale prices for barrel stock averaged $20.00 - $24.00 per barrel throughout the season.

The few men engaged in the seed oyster industry of Maryland started to harvest the 1959 crop and reported that production was lower than in 1958.

FINFISH: Haul seines and gill nets continued to be principal gear in use. The catch of striped bass continued high, wholesale price averaging $14.00 - $15.00 per 100-pound box. The catch of white perch approximated last month's with a drop in wholesale price which now averaged $10.00 per box. Shad started to enter the waters with very light catches reported thus far. The wholesale price was up and averaged $40.00 per box for roe shad and $25.00 per box for bucks. Alewives (river herring) were caught in increasing quantities over the previous month by some pound nets as well as the haul seines and gill nets. The price averaged 1½ cents per pound.

OCEAN CITY: Activity with the trawl fleet was light with only four vessels operating about one day a week each. Fluke was the main species landed, the wholesale price averaging $22.00 per box for large, $14.00 per box for medium, and $9.00 per box for small. Scup (porgy) was second and averaged $3.00 per box all sizes. Sea bass and butterfish made up the bulk of the remainder of the catch.-
MARKET NEWS SERVICE, U. S. FISH AND WILDLIFE SERVICE.

NEW PUBLICATIONS ISSUED

A number of technical and educational printed pamphlets have been published by the Department of Research and Education since the last partial listing in the January-February 1957, Volume 13 (5), issue of Maryland Tidewater News. Another partial listing was in August 1955, Volume 12 (3), issue of Maryland Tidewater News. Included also are Miscellaneous Publications for which reprints are available.

Contributions

No. 106. VAN DEUSEN, R. D. 1954. Maryland freshwater stream classification, by watersheds. 30 pp. May 1954.

No. 108. WELLS, HARRY W. 1957. Abundance of the hard clam **Mercenaria mercenaria** in relation to environmental factors. Reprinted from ECOLOGY, Vol. 38 No. 1, pp. 123-128, January 1957.

No. 109. GRIFFITH, RUTH E.. 1957. A portable apparatus for collecting horizontal plankton samples. Reprinted from ECOLOGY, Vol. 38, No. 3, pp. 538-540, July 1957.

No. 110. WALBURG, CHARLES H. 1957. Relative abundance of Maryland shad 1944-52. F&WS Research Report No. 38, 17 pp.

No. 111. SCHWARTZ, FRANK J. 1958. The breeding behavior of the southern blacknose dace, **Rhinichthys atratulus obtusus** Agassiz. Reprinted from COPEIA No. 22, pp. 141-143, June 18, 1958.

No. 112. MANSUETI, ROMEO. 1958. Eggs, larvae and young of the striped bass, **Roccus saxatilis.** 35 pp. April 1958.

No. 113. MANSUETI, ROMEO. 1958. The development of anal spines and soft rays in young striped bass, **Roccus saxatilis.** 12 pp.

No. 114. FLYGER, V. F. 1958. Tooth impressions as an aid in the determination of age in deer. Reprinted from Journal of Wildlife Management, Vol. 22, No. 4, pp. 442-443. October 1958.

No. 115. SCHWARTZ, F. J. and J. NORWELL 1958. Food, growth and sexual dimorphism of the redside dace, **Clinostomus elongatus** (Kirtland), in Linesville Creek, Crawford County, Pennsylvania. Reprinted from The Ohio Journal of Science Vol. 58, No. 5, pp. 311-316. September 1958.

No. 119. STEWART, R. E. and J. H. MANNING. 1958 Distribution and ecology of whistling swans in the Chesapeake Bay region. Reprinted from The AUK, Vol. 75, pp. 203-212. April 1958.

Educational Series

No. 41. BEAVEN, G. F., BETTY W. BRISCOE and L. E. CRONIN 1957. Chesapeake Biological Laboratory. 31 pp.

Resource Study Reports

No. 12. MANNING, J. H. and H. T. Pfitzenmeyer. 1958. Exploratory survey of tidewater bottom, Somerset County, Maryland; A Preliminary report 6 pp. February 1958.

No. 13. FLYGER, V. F. 1958. The status of white-tailed deer in Maryland, 1956. 9 pp. March 1958.

Miscellaneous Publications

FLYGER, V. F. 1958. Deer checking - how and why. Reprinted from MARYLAND CONSERVATIONIST, Vol. 35, No. 1, 4 pp. January 1958.

SCHWARTZ, FRANK J. 1958. Lampreys of West Virginia. Reprinted from WEST VIRGINIA CONSERVATION, Vol. 21, No. 12, pp. 8-9. February 1958.

SCHWARTZ, FRANK J. 1958. Threadfin shad - a new forage fish for West Virginia. Reprinted from WEST VIRGINIA CONSERVATION for June 1958, 2 pp.

MANSUETI, ROMEO. 1958. The Cranesville pine swamp. Reprinted from The ATLANTIC NATURALIST, Vol. 13, No. 2, pp. 72-84. April-June 1958.

MANSUETI, ROMEO. 1958. The hickory shad unmasked. Reprinted through the courtesy of NATURE MAGAZINE, Vol. 51, No. 7, pp. 351-354, 386. August-September 1958.

SCHWARTZ, FRANK J. 1958. Confusing fishes of West Virginia. Reprinted from WEST VIRGINIA CONSERVATION, 2 pp. January 1959.

ESTUARINE RESEARCH SOCIETY MEETS AT SOLOMONS

The Atlantic Estuarine Research Society is convening at the Chesapeake Biological Laboratory at Solomons on May 8 and 9 for exchange of ideas and information.

This research group is unique in its special attention to the problems of the productive, but complex, bays and estuaries along the Middle Atlantic Coast. The Society was founded in 1947 to bring together biologists, chemists, physicists, geographers and any other research scientists who are active in research in estuaries. Papers are informal and discussions are unlimited.

The Society has been extremely valuable to the participating members and to the states and Federal Government in providing an opportunity for progress on important economic and fundamental problems.

OCEANOGRAPHERS SURVEY CONOWINGO LAKE

CONTINUED FROM PAGE 6

Parent Project Probes Passage Problems

This new study is part of a larger three-year Susquehanna Fishery Study which is designed to provide a sound biological basis for the decision as to whether a passage should be provided for migratory fish at Conowingo Dam. The broad study deals with: (1) the kinds and numbers of fish that reach Conowingo Dam from below and (2) the effects of a passage on those fish into the reservoir. The study will also help provide new knowledge of the basic biology of several species, population size, spawning of resident and anadromous species, as well as the effects of dam operation on young and adult fish.

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Volume 15 | MAY - JUNE, 1959 | No. 3

CLAM WORMS, NEANTHES SUCCINEA SWARM NEAR SOLOMONS, MARYLAND

Many of the personnel of the Naval Ordnance Laboratory near Solomons, Maryland, as well as the local populace were greatly surprised and fascinated on the calm evenings of May 27-29, 1959. On these evenings, between the hours of 10:30 P. M. - 3:00 A. M., E.D.T., millions of clam worms, **Neanthes succinea,** swarmed about the lighted N. O. L. boat landing pier. Although two other well lighted piers, Pier I and the "T" Pier were within several hundred feet of this pier, no swarms were seen at thes piers. The Chesapeake Biological Laboratory pier, site of many previous swarmings, did not exhibit this phenomenon. Thus, commencing about 10:30 P. M., E. D. T. clams worms began to come to the surface, rapidly and randomly swimming about. By 1:30 - 3:00 A. M., the peak of the swarm was reached when entire water areas 150 feet long, 10-15 feet wide and approximately 6 inches thick were obscured by the wiggling bright red or green worm. Each successive night found the swarm's peak about an hour later than the previous night: 1:00 A M., May 27; 2:00 A. M., May 28 and 3:00 A. M., May 29. This time corresponded roughly to one hour after low tide which occurred 12:02 A. M., 1:10 A. M. and 2:23 A. M., respectively. **Neanthes** are strange in that swarms occur during the last quarter phase of the moon. The last quarter for May 1959 occurred on May 29.

Density of Swarming Worms Runs Into Gallons

The reproductive stages or heteronereides are about 2½ - 3 inches long. The anterior one-third of the bright red colored males is cream colored. Females were often a dull green color. Many more males than females were evident each night of the swarm. A 10 foot tow of a a one foot diameter plankton net resulted in a pint of concentrated worms. If extrapolated to cover the area noted above, millions as well as gallons of **Neanthes** swarmed each of the three nights. The water temperature during the swarming period ranged between 69-72 degrees Fahrenheit. The salinity was 13 parts per thousand.

Previous records at this laboratory note swarms of these worms in 1952, 1953, 1954 and 1957. Aso in 1954 swarms were observed during the months of April to

(CONTINUED ON PAGE 12)

GONAD DEVELOPMENT AND SPAWNING OF THE SOFT CLAM

Mya arenaria, more commonly known as the soft shell clam, or manninose, occurs in the Western Atlantic from Labrador to Cape Hatteras, North Carolina. Previously, much of the exploitation of the animal, both scientific and commercial, had been concentrated in its northern ranges. Now that Maryland, which is in the animal's southern range, has become a major soft clam producing state, various studies have been, and are being undertaken to find out more about the life history of **Mya** as it occurs in the southern portion of its range.

One of these studies, carried out in the summer of 1958 at the Chesapeake Biological Laboratory, was concerned with the gonad of the animal as an indication of its spawning condition. There were several reasons for which this study was undertaken. First of all, there has been some doubt as to how often the soft clam spawns in one year. A major spawning occurs in late summer or early fall, and a secondary period of spawning is thought to occur in the spring of the year. It was hoped also to determine, or to be able to predict, fairly accurately the date or dates of maximum spawning. A study such as this one, concerned with the development and structure of the gonad, turns out to be essentially a study of the growth of eggs and sperm within the gonad. Thus, through the means of histology, the microscopic study of stained sections of tissue, it was possible to follow the stages in development of the sex cells (gametogenesis).

Clams for the study were dug with the hydraulic dredge boat, the John A. Ryder, on the western shore of Solomons Island, and samples were taken every two weeks. The size of the animals studied varied from 1 inch to 3½ inches in shell length. To begin the study, it was necessary to find the location of the gonad within the body of the clam. It was soon discovered that a piece of tissue cut from almost any part of the body would contain a portion of gonad. The gonads occupy the majority of the visceral mass, or the body of the clam After the tissues were put through the histologic procedures necessary to kill, fix and render them transparent, they were cut on the microtone into sections 10 microns (1/2500 of an inch) in thickness, mounted on glass slides and stained. The stain found to be quite suitable for the study was hematoxylin, a nuclear stain. It turned out to be quite good in differentiating the sex cells from other materials present in the gonad.

According to Coe and Turner, co-authors on a book

(CONTINUED ON PAGE 10)

GONAD DEVELOPMENT AND SPAWNING OF THE SOFT CLAM

(CONTINUED FROM PAGE 9)

published in 1938 entitled "Development of the Gonads and Gametes in the Soft-Shell Clam **(Mya arenaria),**" the gonads consist of root-like masses of vacuolated follicle cells. These are called alveoli and are the basic structural unit of the gonad. They are the structures which contain the eggs and sperm. Previous to the time that the gonads become ripe and readily show the appearance of ova and sperm, these alveoli are packed with rounded granules, or inclusions of various sizes, and a cross sectional view of them appears like the drawing in Figure 1. This illustration demonstrates another occurrence, which takes place just prior to the appearance of ripe eggs and sperm. The cells within the alveolus begin to disappear, forming a central lumen ("lake" or space) into which the ripe eggs can extend. Even in these early stages during which the granules are present, it is possible to determine whether the clam is male or female, for in the male the granules are much smaller and uniform in size and are much more numerous.

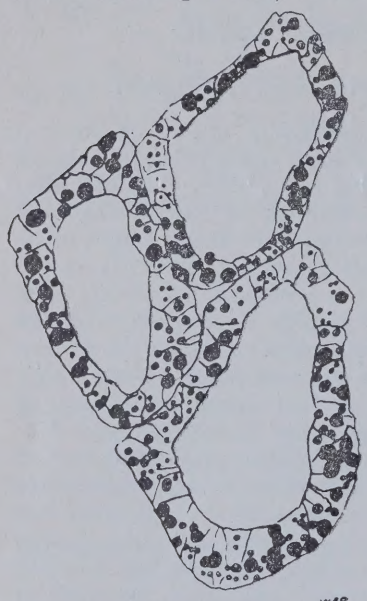

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FIGURE 1. ALVEOLI OF A 2" FEMALE CLAM TAKEN ON 27 AUGUST, SHOWING CENTRAL LUMEN AND INCLUSIONS.

Throughout most of the summer, sections of gonad tissue continued to exhibit this very great abundance of the rounded granules in the alveoli. Then in August the granules began to disappear and the central lumen began to form in the alveoli. This occurred earlier in the female than in the male. The final stages of gametogenesis, or maturation, took place during the last few days in August and the first week or so in September. In male gonads from 9 September, the granules had disappeared and the alveoli were packed with sperm cells (Figure 2). The females had undergone a similar change, for on this date the granules were mostly gone, the cells were broken up and the alveoli contained anywhere from 5 to 15 ova each, depending on the size of the alveolus (Figure 3.). As can be seen in Figure 3, some of the eggs are still attached by slender stalks to the walls of the alveoli and some have broken loose. Those that are free from the wall are ripe and are ready to be expelled in the act of spawning. Spawning probably occurs when most of the eggs are freed from the walls. This is just part of the picture for there are other, more important factors influencing spawning, such as water temperature, salinity and stimulation by other clams.

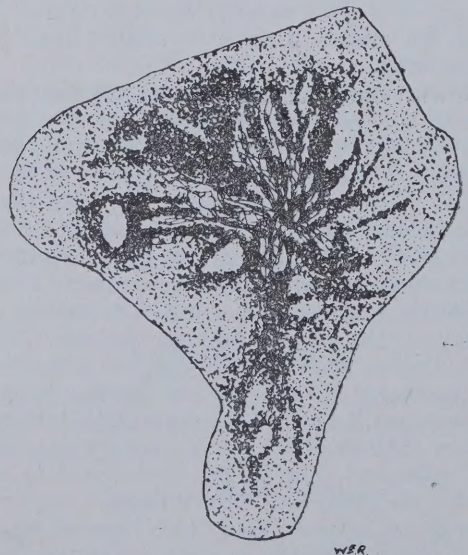

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FIGURE 2. ALVEOLUS OF A 2-1/2" MALE CLAM TAKEN ON 9 SEPTEMBER. SHOWING RADIAL COLUMNS OF SPERMATOZOA.

According to results obtained from spat traps in the water, there was a clam set beginning about 22 September and extending for a period of about a month to 28 October. The spat trap gives a relative picture of the increase or decrease of new clams present in the water. A set is the actual settling of the clam larva, following the free swimming stage, to the bottom. This free swimming stage lasts from two to three weeks. So that, very shortly after the first appearance of ripe eggs and sperm, possibly a week or less, the clams probably began to spawn.

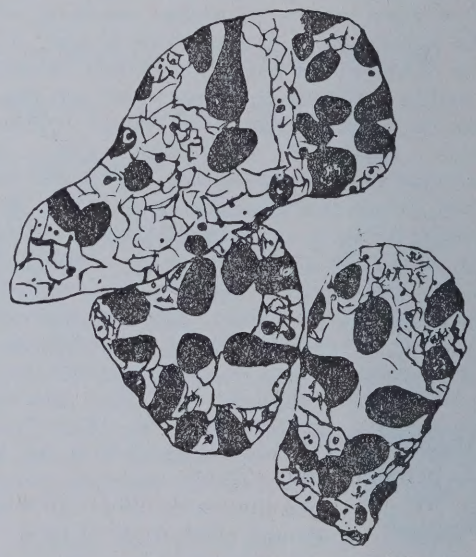

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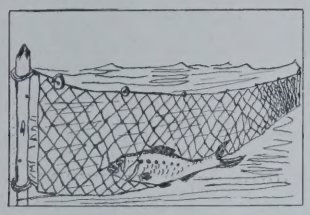
FIGURE 3. ALVEOLI OF A 2" FEMALE CLAM TAKEN ON 9 SEPTEMBER, SHOWING DEVELOPING OVA (BLACK - STAINED CELLS) AND REMNANTS OF FOLLICLE CELLS (BROKEN CELLS).

This study has been carried on throughout the winter and spring and will continue through the summer and fall, so that the results of two spawning seasons can be compared, perhaps leading to a time correlation between development of mature sex cells and spawning. - W. E. ROGERS.

POTOMAC RIVER PRODUCTION - 1958

Virginia commercial fishermen have been licensed by the Maryland Department of Tidewater Fisheries since June 1957 to fish the Potomac River. The Maryland legislature, which had abrogated the Potomac River Compact of 1785 in February 1957, required Virginians to have Maryland licenses to fish this Maryland river. In 1958, 106 Virginians and 185 Maryland commercial fishermen were licensed to fish in the Potomac River. This was the first full year that comparable catch records were available from fishermen of both states. The findings in this article are based on those records, fishermen's remarks and from observations in the field. (All statistics used are preliminary ones based on 99 per cent returns and subject to slight increases.) These statistics are collected and compiled through the cooperative efforts of the Maryland Departments of Research and Education and Tidewater Fisheries and the U. S. Fish and Wildlife Service.



Potomac River Species - Ranked by 1958 Production (in Thousands of Pounds)

	MARYLAND		VIRGINIA	
Rank	Species	Quantity	Species	Quantity
I	Striped Bass	562	Alewives	8,081
II	Spot	264	Menhaden	2,872
III	Croaker	124	Spot	668
IV	Alewives	73	Striped Bass	521
V	Carp	68	Gizzard Shad	349
VI	Catfish	59	Croaker	319
VII	Shad (White)	49	Catfish	136
VIII	White Perch	35	Shad (White)	115
IX	Gizzard Shad	12	White Perch	71
X	Yellow Perch	4	Carp	43

The same species appear ranked in the first 10 except for menhaden, excluded from the Maryland list, and yellow perch, excluded from the Virginia list. The Virginia shore has few suitable tributary streams for spawning of yellow perch and very few are caught there. The absence of a large pound net fishery on the Maryland side accounted for the dearth of menhaden in that state's catch. Virginia's total of all species was 13,940,00 pound, while that of Maryland was 1,258,00 pounds for the river. When the landings of alewives, gizzard shad, menhaden and other industrial fish are not considered in the totals, Virginia landings were one and one-half times those of Maryland.

Each State Seeks Different Species

Virginia fishermen set pound nets primarily for those species (alewives, menhaden, gizzard shad, etc.) used in reduction plants and canneries. Virginia cans the alewife (herring) roe and reduces the industrial fish for oil and meal. For food fish such as striped bass, croaker, roe shad, spot and white perch they fished stake gill nets and haul seines. Maryland fishermen, in contrast to their southern neighbors, have little use for industrial fish; they use some directly for fertilizer and crab pot bait or return such species to the water. Marylanders used stake gill nets and haul seines for the above named food species, as well as for yellow perch. As is the practice throughout this area, most of the Maryland and Virginia landings were sold "in the round" i. e., as whole ungutted fish.

Fishing Effort Intensified During Spring

Fishing effort was concentrated during the spring in both states. Fish that grouped for their spawning runs upriver, such as alewives, gizzard shad, white shad, striped bass, white perch and yellow perch, were the exploited species.

Species taken by haul seines in Maryland, and by haul seines and pound nets in Virginia, from June into September were mostly the summer migrants such as bluefish, croaker, spot and gray trout. In the fall Virginians again set their pound nets for catfish, menhaden, striped bass and white perch.

Periodically during the year some haul seiners caught carp almost as if they were filling orders for that species. Several Maryland haul seiners, who landed catfish, impounded them for shipment alive to other southern states.

The writer wishes to thank the Potomac River fishermen from both states for making this study possible by their continued cooperation during the past year. - G. J. MURPHY.

WINTER AND SPRING TAGGING OF STRIPED BASS CONCLUDED IN POTOMAC RIVER

Fishermen Urged to Return Tags

A Total of 2,200 Striped Bass Tagged in 1959

Potomac River and Chesapeake Bay fishermen are alerted to look out for tagged striped bass, or rockfish. They are urged to examine carefully each fish they catch for a yellow plastic oval disk trailing from a nylon thread attached through the hind part of the back. A one-dollar ($1.00) reward will be sent to fishermen who return tags with full recapture information to the Beaufort, North Carolina address printed on one side of the tag.

A total of 2,200 fish were marked during winter and spring of 1959 in the Potomac River from its confluence with Chesapeake Bay to the region of Indian Head, about 60 miles from the mouth. This tagging project was part of a cooperative study of the Virginia Fisheries Laboratory, the U. S. Fish and Wildlife Service striped bass investigations group based in North Carolina, and the Chesapeake Biological Laboratory.

Most Tagged Fish Weighed Between 2 and 3 Pounds

The fish were puchased, tagged, and released alive from commercial nets of cooperative Maryland and Virginia fishermen during the height of the spring fishing season. Most of them came from stake gill nets with the balance from pound nets, drift gill nets, and haul seines. Some were tagged from a research trawler during winter (Maryland Tidewater News, 45 (1): 3-4). The fish consisted largely of two and three pound fish, although smaller and larger sized individuals were tagged. A few of the larger individuals, mostly female or "cow" rock, weighed between 25 and 54 pounds.

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WHITE COWNOSE RAY, RHINOPTERA BONASUS, FROM TANGIER SOUND, MARYLAND

On May 22, Mr. George Dreyer and his crew captured in a haul seine near Great Shoal Light, Wicomico River, Tangier Sound, Somerset County, Maryland, a mature white colored male cownose ray, **Rhinoptera bonasus** (Mitchill). The speciment, 971 mm. (31-13/16 inches) maximum wing width and 1470 mm. (48-3/16 inches) total length, was a normal cownose ray (skate or bullfish as it is known locally) in all respects except that it was snowy white both dorsally and ventrally. The eyes were their usual black color rather than pink - ruling out any albino condition, which is known for other fishes. Since the specimen was gutted on arrival, only an approximate weight of 30 pounds, a weight normally attained by fish of this size, can be ascribed to it. The dorsal surface, spiracles and dorsal fin were all white. The dorsal surface of the tail was a dusky color while ventrally it was white. Normally this fish is brown in the above areas while the tail is jet black. The ventral surface of cownose rays is white. Again through the thoughtful efforts of Mr. Dreyer and the Tidewaters Fisheries Department personnel who delivered the specimen to Solomons, information on a valuable and rare specimen has been made possible. Many thanks are due these fishermen and agencies without whose concern much would be lost to science. - F. J. SCHWARTZ.

WINTER AND SPRING TAGGING OF STRIPED BASS CONCLUDED IN POTOMAC RIVER

(CONTINUED FROM PAGE 11)

It is of interest to note that during tagging on or near the spawning grounds off Quantico, Virginia, some of the females were in ripe spawning condition. In the last week of April, thousands of large floating eggs were also observed in the Potomac.

Some of the Tagged Fish Have Been Recaptured in the Potomac

Most of the recaptured fish have been caught by fishermen throughout the river system while a few have been taken in Chesapeake Bay. The vast remainder of fish are still at large and represent as much as $1500.00 worth of marked individuals available to fishermen.

The striped bass of the Potomac River was selected for study because they represent at least one or two stocks of fish which do not appear to move as extensively or as far as other stocks of striped bass in the Chesapeake Bay. The objectives of the study during 1959 are: (1) to determine seasonal and annual migrations in and out of the Potomac and Chesapeake Bay; (2) to understand the nature of the striped bass fishery by anglers and netters; and (3) to locate sources of tag recoveries from all fishermen in the Potomac and elsewhere so that future studies may be planned more efficiently. These objectives will ultimately aid biologists to manage the striped bass resource so that the most effective use of this species may be obtained by the public.

-R. J. MANSUETI.

DANGEROUS MARINE ANIMALS

by Bruce W. Halstead, 1959, 176 pp., 6 x 9", Cornell Maritime Press, Cambridge, Maryland, illustrated with 123 halftone photographs, 34 line drawings, 4 maps, 15 color illustrations. $4.00

With the advent of skin diving via "SCUBA" diving equipment, many people from all walks of life are entering the sea to explore the fascinating quiet watery domain of the fish, coral, crab and jellyfish. Dr. Halstead attempts to solve the perplexing problem as to what animals below the sea are or are not dangerous to man. In the short space that this work encompasses, 14 years of research on these aspects are quickly, clearly and simply put before the layman, the skin diver, shell collector, physician, explorer and biologist. The book is divided into four chapters: Dangerous Marine Animals — Our Knowledge Of The Past; Marine Animals That Bite; Marine Animals That Sting; and Marine Animals That Are Poisonous To Eat. This is followed by a short general selected bibliography on important aspects or groups that have been discussed. In every case, the species identification, geographical distribution, habits and noxious characteristics are briefly discussed along with the medical aspects, treatment and prevention. The technical aspects of the poisions, themselves little understood or known, are omitted along with the thousands of medical histories on which the data is based. These will appear in a more complete volume entitled "Poisonous And Venomous Marine Animals Of The World." An interesting discussion of jellyfish nematocysts as well as the spines or fangs of biting animal is found in Chapter II. Adequate illustration of species, theories of poison origin and geographical distribution readily help the reader to undersand the type of organism producing the bite or sting and the poisonous affects of eating certain organisms. The size of the book, paper and type face used all add greatly in making this inexpensive volume enjoyable to the reader. - F. J. SCHWARTZ.

BOY SCOUT TOURS AT THE CHESAPEAKE BIOLOGICAL LABORATORY

This spring the Chesapeake Biological Laboratory held a special series of tours for Boy Scout in the Southern Maryland District, comprising Calvert, Charles and St. Mary's Counties. The program was designed primarily to stimulate interest in the Merit Badge achievements of the Scouting movement. Ten Scout units with a total of approximately 225 boys took advantage of the special tours.

CLAM WORM, NEANTHES SUCCINEA, SWARM NEAR SOLOMONS, MARYLAND.

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July. Spawning during these periods occurred in water of 63 - 79 degrees Fahrenheit. An interesting point to note is that although this worm's spawning cycle occurs on a lunar period, many past as well as the current observations note that the swarm occurs regardless of whether or not the moon is overcast. - F. J. SCHWARTZ.